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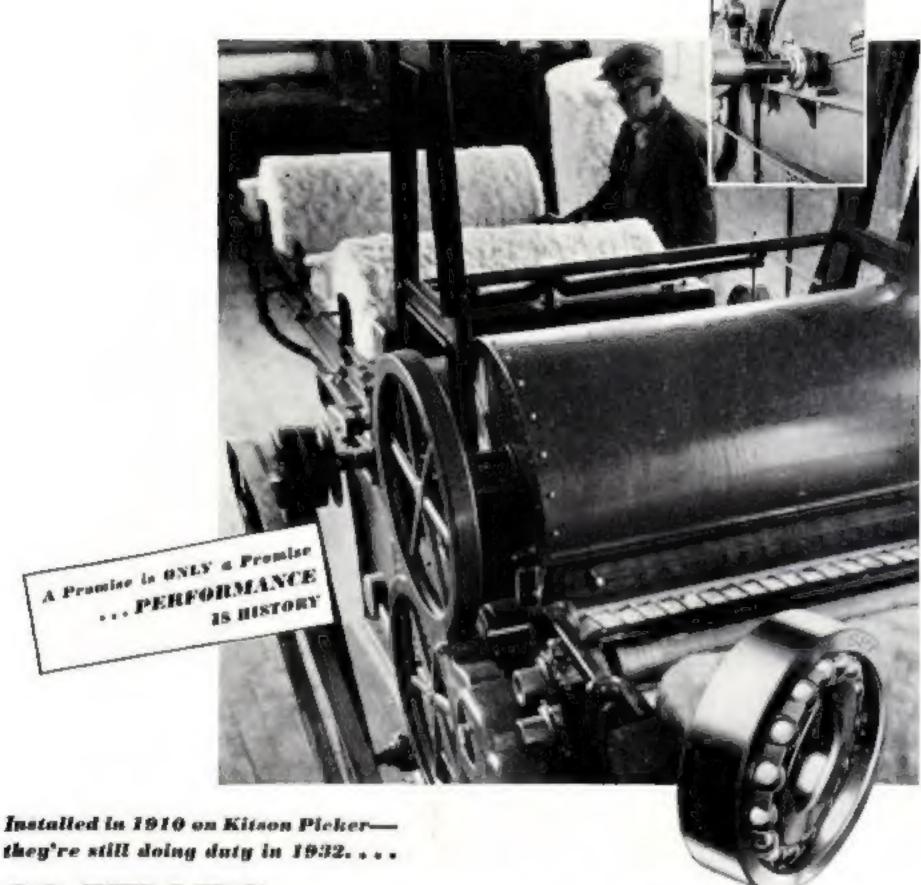


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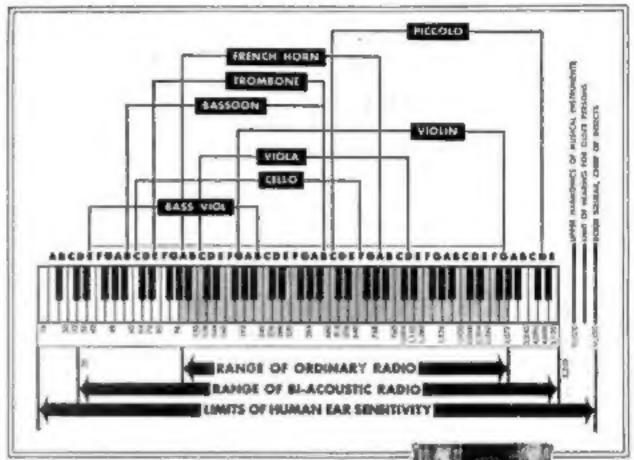
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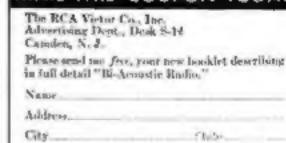
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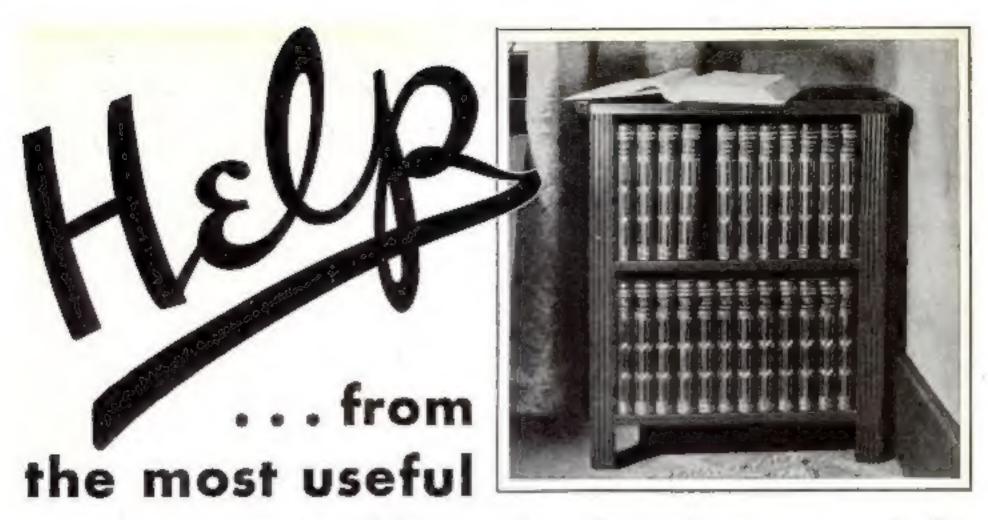
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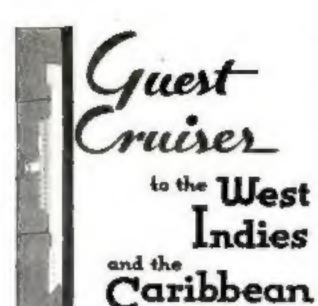
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A plain statement

IMPORTANT INFORMATION FOR THE

In an effort to clear up the confusion regarding anti-freeze, which appears to exist in the minds of many consumers, we give below the outstanding facts. The following statements are guaranteed to be correct and accurate in every particular. They are supported by the highest scientific authorities.

THE problem of preventing freezing in the cooling-systems of automobiles during the cold weather months was one that taxed the ingenuity of car owners for many years. Salt, honey, alcohol, kerosene, glycerine and many other products and by-products were used with varying success. Within the past few years, however, there has been developed a new product, a product specially designed for this one use and purpose.

That product is Eveready Prestone. It is not a general commodity used principally for other purposes: it is an anti-freeze, and nothing else. It is a scientific development, thoroughly approved by all car manufacturers; a product which embodies all the advantages of all materials previously used, with none of their inherent weaknesses.

In developing Eveready Prestone, the laboratories of Union Carbide and Carbon Corporation, keeping in mind the requirements of the U.S. Bureau of Standards for an ideal anti-freeze, worked toward a product which would satisfy the following specifications:

1. It must not boil away. A boil-away anti-freeze is both an inconvenience and a poor protector against

sudden changes in the weather. Such anti-freeze requires frequent renewals and lesves the car unprotected when a cold soap follows warm weather.

- 2. It must be harmless to the cooling-system. An anti-freeze which corrodes the cooling-system is a poor product to put in a car.
- 3. It must be effective in preventing freezing. The effectiveness of the materials commonly used before the advent of Eveready Prestone varied over a wide range. Some were effective in preventing freezing; others were not.
- 4. It must not affect the car finish. The fumes of boil-away products were a source of danger to the finish of fine cars. This was a weakness which those who developed Eveready Prestone were anxious to avoid.
- 5. It must circulate freely at the lowest operating temperatures. A heavy, viscous material, which is not free-flowing, is obviously a poor cooling-agent.
- 6. It must be non-inflammable and odorless. Winter driving was often made unpleasant by smelly fumes,

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of facts concerning

PROTECTION OF CAR OWNERS

while inflammable mixtures held the possibility of causing serious accidents.

- 7. It must not "treep." Certain materials in common use had a strong tendency to leak out of systems which were tight enough to hold water but not tight enough to hold these materials. The new product, it was felt, must have less tendency to leak their swater. Consequently, if a car could hold water it would hold the anti-freeze.
- 8. It must be packaged as a concentrated product. Many of the products which the public was using, because of their thick, heavy nature in the concentrated form, were sold as water-diluted solutions. The cost of canning and shipping plain water was thus borne by the public. Obviously, if a concentrated product could be packaged and sold the user could be saved that expense. Furthermore, the public had no way of telling how much of these diluted solutions was

anti-freeze material and how much was ordinary water. Some brands contained as much as 55% plain water: others contained less. It was decided, therefore, that the new product must be concentrated. Thus the public could be sure of buying a standard product, always the same and always of known value.

9. It must be economical. The laboratories which developed the new product were not interested in low first-cost per gallon. They were interested in low cost per season. It was felt that car owners who had been buying boil-away anti-freeze on the installment plan, a few quarts at a time, would not object to a relatively high first-cost if the all-teams cost were low. The new product, therefore, was priced to cost, for an average winter season, no more than the cost of boil-away anti-freeze.

Thus was developed Eveready Prestone, the only anti-freeze which meets all these requirements. But laboratory effort did not stop with that.

A NEW AND IMPROVED PRODUCT AT A LOWER PRICE

Further research developed the product to a point where it gave protection not only against freezing but also against rust and corrosion in the cooling-system. And such is the new Eveready Prestone. Its use reduces the corrosive action of water on the metals of the cooling-system as follows: brass, copper, solder, aluminum and zinc, 75%; cast iron, 95%. No other "treated" anti-freeze compares with Eveready Prestone for the prevention of rust and corrosion.

The new Eveready Prestone has been reduced in price. It now offers by far the safest and most economical

protection against both freezing and corrosion. The car owner who uses Eveready Prestone is assured of complete protection through all weather changes, freedom from worry and the trouble of replacements, and a clean, rust-free radiator. He insures his car, not only against a freeze-up, but also against the costly repairs that follows rust-clogged and corroded cooling-system. He prolongs the life of his car.

National Carbon Company, Inc., Unit of Union Carbide and Carbon Corporation, New York, N. Y.

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What Makes Building and LOANS So Safe?

By LEON MEADOW, Financial Editor

WANT to learn all about building and loan associations," John Carr told George Badger, the man to whom he had been referred by the girl at the information desk. "I came in without any intention of investing money, but if your story is convincing enough, I can be

Ordinarily Badger had no time for answering such general inquiries. But in this case, he saw the wisdom of selling Carr and, through him, many men of his type. "Well," he started, "to begin at the beginning, the first building and loan society in this country was formed at Frankford, Pennsylvania, in 1831, Its total assets to start were \$224, and its sole purpose was to provide funds to secure homes for every citizen of that small town. Other than that, the society had no reason or plan for further existence. But the idea was too good to stop there. Today, 101 years later, there are over 11,000 building and loan associations with total assets of almost nine billion dollars in business, and their scope is somewhat broader than that of the original society.

"HERE is how the typical association now operates: First, taking the membership side of the picture, there are three distinct types of shares which may be purchased by members. One is the installment share—the original, and still most popular of all three. Members subscribe for shares of stock which have a fixed par value. By periodic payments of small amounts these shares are matured, and to them at regular dividend dates are added the dividends carned by the association. Because this dividend rate varies from year to year, the time required for the maturity of installment shares is dependent upon the prevailing dividend rates and also upon the size of the installment payments made by the subscriber,

"The next type is that of prepaid shares, These are designed for larger sums of money and are paid for in a lump sum at the time of subscription. This sum is equal to the amount which will mature these shares in a given period of time, at current dividend rates. Accumulated dividends are credited to the shares subscribed for, and eventually they mature at par.

"The third type is called full paid or income shares, and they provide another kind of investment for larger sums of money. Subscribers pay par value for these shares at the time of subscription, and receive cash dividends at each dividend date of the association."

"You've said a lot about dividends, Mr. Badger, and I understand from you that they vary from year to year. What is the average dividend rate now?"

"Figures for 1937 aren't completed yet, But the figures for 1931-and you know what kind of a year that was-showed that shareholders throughout the country received close to half a billion dollars in dividends-an average of 51/5% on their investments. As a matter of fact, the earnings of all associations compared favorably with those of other years. In no recorded cases did they drop more than 1% from the dividend rates of 1930.

"The money deposited in building and loan associations by share holders is invested in mortgage loans on owner occupied homes. The associations are the only institutions in our money and credit structure which confine their lending operations to home financing, and provide this homeowner credit on the specialized plan of an amortised mortgage."

"How does that work?" asked Carr. "It allows," replied Badger, "for peri-odic repayment of the principal of the man, as well as interest on the mortgage, out of the current earnings of the borrower. These payments are usually on a monthly basis, interest and principal sums being lumped together to give the borrower a fixed obligation each month to the association. As you can see this plan steadily decreases the company's risk on any given loan. The period for repayment of these loans runs, as a rule, from eight to eleven years, depending upon the size of the installments. When the loan is made the borrower signs an agreement to make these regular payments. His personal note is secured by the mortgage which is an actual

lien on the property pledged. "The amortisation provided for hy monthly payments gives a building and loan association a contractual income from all its loans and reduces the actual amount outstanding on each by from 9 to 121/4% a year, according to the length of the loan, And bere's the big point-because of this constant reduction of the amount outstanding on any particular loan, building and loan associations have found it possible to lend up to 65% of the home value. And what's more, this high percentage financing is done by these associations without any of the harrassing charges of second mortgages. Mortgages held by organizations like ours are ranked for safety quite as high and higher in many cases than any straight mortgage limited to 50% of the home valuation.

"All these associations are organized on a local basis. They confine their lending operations to a relatively small locality, within quick access of the association officers who make appraisals, check home construction and investigate borrowers. For this reason, and because their financing plan makes possible 65% loans,

Copprignment masses and

building and loan association lending operations reach a field which banks and insurance companies cannot hope to cover, the field of really small home-owners and futhermore it's a mighty safe field, too.

"The average size of loans made by associations from 1920 to 1930 was \$3 550. Based on 65% loan of total value, the average home on which the associations have lent money would be worth about \$5,300. This reflects a certain type of citizen—the steady, dependable working man who wants to keep his family together, and can acquire the stability of home-ownership only by paying off a home

mortgage by instalments.

An outstanding feature of building and loan conditions in 1931 was the surprising readness with which borrowers continued their monthly repayments of principal in the face of cut incomes, reduced salaries and unemployment. Home financing experts draw two conclusions from this record, one that the class to which associations lend was not bit so hard by actual unemployment, and where income was cuttailed the family was prone to sacrifice luxuries in order to maintain an equity in the home; two, that there is no more stable debtor class anywhere in the country than these home-owner borrowers.

TET me give you a brief idea of how popular building and lean accreties have grown. From 1920 to 1930 assets invested in all these associations more than tripled themselves, many from two and a half hillion dollars to over eight hillions. During this same period, the investors and borrowers have more than doubled their number, growing from 5,000,000 to over 11,000,000. In 1970 there were 8,533 associations. At the end of 1931 there were 11,442 in operation.

Badger sat back in his chair and lit a cigarette. For a minute he was silent, and then he turned to John Carr, "Mr. Carr you came in here to learn about the operations of building and loan societies. But I gather that you are just as much interested in their safety. Is that true?"

John Carr smiled. It is. That was the main question in the back of my mind. One thing that bothered me was strengthened by all your emphasis on mortgages. If ad or practically all, of your money goes into mortgages, what kind of a record can building and loan associations show in these days of vanishing real estate values? How have they held up during 1931

and 1932?

"Your question is well taken," Badger said. "Again the answer is in the figures. In 1930, 190 building and loan associations failed. This was 1.6% of the total of 11,-777 in operation. In 1931 the percentage was 1.1% Figures for 1932 though not completed, will show a further decrease I think that these figures speak for themselves, but if you wish to draw a comparison that will make this fine record seem even more amazing, take the bank suspension figures for 1931. With something less than 20 000 commercial banks in the country, 2300 were suspended in that year. That's more than 10%."

Carr glanced at his watch and rose. "I'm satisfied, rouvinced and sold. Mr Badger And I think the Ajax Building and Loan Association will have a new member soon,"

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The door is open! prove that he can win

ALL they needed was a chance. All they asked LA was an opportunity to show the stuff they were made of. Then they got busy and made the world pay attention!

Maybe you feel the same way about it. Maybe you, too, are ambitious-eager-willing to work hard for recognition that will mean real success in life.

Well, the door isn't closed. OPPORTUNITY herself is holding it wide open!

Never before has the world so keenly felt the need of skilled craftsmen-men who can use their hands as well as their heads-who can design and build and superintend others in building the fine things modern civilization demands.

Five hundred years ago it was easier to find such

men than it is today! Why? Because then the Guilds flourished. Through them, boys and young men were trained to proficiency in manual arts.

Now the very spirit of those great societies has been revived in the Fisher Body Craftsman's Guild, which every boy in the United States and Canada may join.

Organized only two years ago, this modern Guild has already started thousands of boys on their way toward real achievement,

To foster the competitive spirit which means so much in work or play, the Guild sponsors annual competitions, and has distributed more than 2,000 awards for outstanding merit in craftsmanship. The third competition, now in progress, is described on the opposite page.







FRANZ ISISCH CORDON L DRUMM Washington, D. C. Columbus, Wie-

These boys bave earned 4-year University Scholarships







Wenterjen, III.



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10

. . who will enter and success in life?

NOW SIX UNIVERSITY SCHOLARSHIPS Each Valued at \$5,000!

As further incentive to the boy craftsmen of the United States and Canada, the Fisher Body Craftsman's Guild announces the addition of two more University Scholarships valued at \$5,000 each, rusing the total number of annual Guild Scholarships to ave. Four of these scholarships will go to boys of the United States, two Senior and two Junior. Two scholarships will go to Canadian boys, one Senior and one Junior. You can see for yourcelf how this increases your opportunity to earn one of these awards, since now boys of the United States exclusively will compete for four scholarships, while boys in Canada are assured of two scholarships for themselves.

A brilliant future for you may lie in this opportunity to demonstrate your manual skill, your ambition, and your willingness to work

Awards valued at more than 485,000 will be divided among boys who take part in the third annual competition of the Fisher Body Craftsman's Guild. All boys between the ages of 12 and 19 years may enter, and there are no dues or fees of any kind to pay.

Winners of Junior and Senior awards in each state and each Canadian district (112 boys in ail) will be delegates and guests at a great Convention to be held in Chicago at the time of the "Century of Progress" Exposition.

Here will be presented the six university scholambips, valued at 45,000 each, which constitute the major awards for outstanding craftsmanship.

Any ambitious boy with two bands, and a head on his shoulders, can do the work assigned for this competi-

tion. Just how well he does it -how high he stands when the awards are made—will depend entirely on his desire and ability to excel and his willinguess to stick to the job until it is finished.

The judges in this contest, as in preceding ones, are outstanding educators and men who stand high in the knowledge of craftsmanship. At their head as Honorary President of the Guild is Daniel Carter Beard, National Boy Scout Commissioner. Honorary President of the Canadian Section is John A. Stiles, Dominion Commissioner for Scouting.

Join the Guild and enter the competition. Meet other ambitious boys make lifelong friendships—and aim at the highest award, a four-year university scholarship! Don't waste a minute. Get going NOW!

HOW TO BECOME A GUILD MEMBER

It's easy to become a Guild member. Just go to any dealer in General Motors cars (Cadillac-LaSalle, Busck, Oldsmobile, Pontiac, Chevrolet) and say you want to join, He will do the rest. Your Manual Training Teacher also can take your application—or the local Boy Scout Leader Or you can simply fill out the coupon at the right and mail it to Guild headquarters. Shortly after enrolling you will receive your membership card, an afficial Guild button, and complete information about the Guild craftsmouthsp competition for 1933.

		Manual Training
Boy's Name		Toucher
Enrolled Before	2 tes 25	O Principal
Bornday of	Month 1	Grade
Address	Month 1	Parent or Guardun's Name
City.	State	Address

CRAFTSMAN'S GUILD

Our Readers That's All Right, But Where HERE'S one I ran across that mucht be

Do You Get the Cent?

interesting to your readers. A reat's worth of electricity would furnish power to keep a musical note sounding on a radio set from now for sixty milhon years. Radio, they tel-

us, is one of the most sensit ve instruments ever devised and will produce an audible sound on a bill onth of a watt of electricity Can some of our readers tell us the answer, then, to this one, As I listenin spite of myself to my neighbor's



radio, am I right in assuming that he must be using at least ten dollars worth of electricity to get that seemingly tireless crooner and the shaving soap ad man? Or is that putting too low a price on the power used? And what would be the value of the dynamite needed to blow 'em both sky high and save to) poor cars?-P.D., Oakland, Cauf.

That Evolution Business Bobs Up Once More

IN A recent issue of Porttak Science Montilly, M.S.R., Electra, Tek., says if one accepts the theory that man descended from apes, he must reject the statement that man descended from Adam and Eve, which the Bible teaches us to believe. Does evolution teach that man descended from an ape or dnes it teach that the branch of the apc family and the branch of the map family had a common origin, and man will always he a man and an ape an ape? It has been agreed by all, that man has two natures, an anomal and a spiritual nature. There is no doubt, he got has animal nature from the same place the animals got theirs, and developed along the lines as outlined in Portuan. SCHOOL MONTHLY by Mr. Mak a few months ago. As it took a long while to develop the animal nature, it no doubt took as long to develop the spiritual nature, and for that purpose the Lord put Adam and Eve in the garden of Eden. In order that the spiritual nature should not be hampered by the animal, the Lord caused a deep sleep to come over Adam und from his rib made a woman, and he did not map out of it till they are of the forbinden fruit.-W.L.H., Larned, Kan-

After all, It's Merely a Question of Backbone

With you please ask your readers to answer

the one for me; Authorities say that we are tailer when we lie down than when we stand up. In some cuses, the difference amounts to an inch. The wise acres say that the difference is due to the fact that people don't stand straight I think that's



all huns. I feel the difference is due to the weight thrown upon the cartilage between the vertebrae. Am I right or wrong?-

C W.G., Des Moines, Iowa

We Thought We Had Already Told All About Auto Recing

Term is a request from a reader who has tend your magazine for a number of years Every month when the new usue arrives 1 first read the pages entitled, "Our Readers Say." There I have read what others want and to I should like to make this request I should like an article on auto racing, something that will lell us how these cars are built, and a general description as to how they work, and of what value they are to the automobiles that we drive today, I wonder how many others would be interested in this some subject .- PBR. Erdenheim, Pa.

Here's One Reason Why Water in Diesel Engine Won't Work

I HAVE read POPULAR SCHENCE MORTHLY for some time, but the problem of V.E.J., Pasadena, Cabif., got my goat. What could be more illogical than to run a Diesel engine by spraying water late the hot cylinders in place of oil? He says there must be something wrong with it or someone would have tried it before. He's right! There is something wrong. It would be quite a job to keep

the cylinders bot, woold it set if you aprayed cold water into them? You might use a blow torch Pardon my saracasm. May Lask a question? Has M H., Fleetwood N figured nut the problem of insulating a thousand foot



animize flash so that it won't electrocute his own troops? That a enough in questions for one time. I like your magazine and am especially interested in the plans for the hayak canoe. How about stone more advanced chemistry?-L W Z., Noenah, Wisc.

Suggests Some Improvements for Vortex Tube

Is that idea of the Vortex Tube, described in a recent issue, supposed to be serious or did you forget to put the title "SCIEN TIFICKS" at the top of the page? It seems to me somehody a goory somewhere. Wouldn't this tube be too clumsy to move around and if it was collapsible and drawn into the salvage barge, wouldn't it be a 1st more thouble than the artificial lyng and some of the lescomplicated inventions? How could the paddies revolve fast enough to keep the water against the sides of the tube all the way up, especially if the water was very drep? Wouldn't it be better, If you had to use the tube, to put a bottom on it and a suction grip to hold it to the submarine? Then a hatch in the bottom could be opened over the hatch in the sub and the men pass from one to the other and climb a hadder to safety Come on, fellers, let me know what you think of the idea. Maybe I'm the goofy'un. My beartiest congratulations to Postulan Science. You've sure got a great magazine. Let's have some more radio though. Tell us what makes a radio work. What does each part do and how? I'm sure I'm not the only bug that wants to know .- J W.R., Ashville, N. C.

But You Shouldn't Believe Everything You Hear

ALL my life I've harbored the notion that cutting the half frequently will make it grow thicker and coarser. Probably many of your hald bended studers have thought the same

thing. Now along comes the American Medical Association and tells me I'm ad wet, that curting hair bus no effect on it and, by the very nature of things can't have any elwho knows kindly tell me who's sight? I've so more hair



than a billiard ball and cutting and even shaving have left it invisible to the named eye. Has any one any different experience to report?-JBW, Butte, Mont

How Wonderful Is Man When He is Seen Inside and Out

I UNDERSTAND that a robot, called the 'transparent man," will be exhibited at the World's Fair at Chicago next year. This robot will show what goes on inside one when one swallows, chews, cats, or sleeps, That should be interesting—and maybe instructive. But will this transporent man show the processes of metabolism, the action of the endocrine glands, the slow processes of the lymphatic system? I pause for a reply Until these subtle operations are made visible. what can we know about the human body? And there are operations even more obscure, such, for instance, as the things that occur in the brain, which no robot with which I am fam liar la able to show. Aren't these the things in which we, as fundamental scientists, are most interested? Give us a spare up robot and stop chattering.-H F., Peek will N Y

Electricity Did the Trick And Not Visiting Ghosts

Hoory, tosh, and likewise bosh! That's all I have to my about the bell ring-

ng article by W B M The bell prebably was rung by an attendent by electricity from an adjoining room. It may have been run by a spring mecharusm tripped off by something the per



son approaching stepped on. Or, again, an A ray may have been turned upon a selemum cell and when it was interrupted by the approaching person, the cell operated an electric switch that rang it. There are many ways in which it could have been rang but one thing is certain and that is that no spirits or supernatural being did it, as that is impossible.—D.F.C., Mankato, M.no.

If Your Nerves Are Bad, Leave This One Alone

This is what I should like to ask one of your smart teaders to solve for me. Mrs Smith has twenty-seven cows, and Mrs Murphy has twice as many chickens as Farmer Browns hens lay eggs. Now, if one half of

the number of pails of mak that alres of mak that alres as much as one-tenth as much as one-tenth as much as one-tenth as much as alres, Murphys chickens cost per pound how much more would Farmer Brown get for a dozen eggs if three times the number of carves that



Mrs. Smiths cows had were equal to one and one-tenth times more than the number of worms that Mrs Murphys chuckens catch in twenty-four bours, if each chicken catcheseven and a half worms in three minutes and ten seconds. Send me a telegram when someone figures it out, . The real reason of this letter is to ask for the continuation of the amateur radio section by Mr Carr and to say that if Ray Wades stops his chemistry section, I'll shoot him.—V.A.H., Long Reach, L. I., N. Y.

Here's the Latest Report On the Ice-Water Problem

I wish you would ask W.M.G. of Port Washington, N. Y., not to try to mix us up Tell him not to expect too much from his thermometer-it measures temperature alone -and temperature is only the indication of the presence of heat. The amount, or quantity, of heat is measured by h.t.s./a., those little things which make the world go on. There is more beat in 100 lbs of ice than there is in 1 lb. of ice. The temperature is the same. Also it takes a certain well established amount of heat to change a given quantity of ice to water-to change the physical state—and this change takes place with no change in the temperature or thermometer. This amount of heat is called the Latent Heat of Fusion of Ice and in equal to 144 b.t.u's. A mixture of ice and water will give a temperature of 6°C-II we add heat we finally get water at 0°C, and if we take heat away we get see at \$°C. A given quantity of water at 0°C contains more bit it's, then the same quantity of see at the same temperature. And all this makes It just too bad for perpetual motion .- F W Y. Lake Linden, Mich.

Wise People Believe in This Poisonous Hop Toad

I READ somewhere about a monster load in

Mexico that throws out a poison fala to animals. The poison is odorless but powers is and is supposed to kill at a distance of some feet. I read of a small doc that was killed by the poison in half an hour. Other dogs, bring the toad, died



within two or three minutes. Is this all so much bologna? Or is there an element of truth in it? And if so, how much? What is the effect of the poison on human brings?-L.D., White Plains, \ \}

' Black' Objects He Sees As Something Not Black

I waxy to report a phenomenon which I have observed in the realm of optica. I can't account for it nor have I read anything about it anywhere. I have noticed that a piece of coal, the black fender of a car a black piece of phonograph record, and many other things are not the black rolor they appear to be. If you look at coal in bright sunlight with the naked eye or through a small lens, you will find its black surface composed of tiny, almost microscopic points of different colored baht. If you move the object as you look, you will see what seems to be an effect of all the color points shifting or moving over the surface. Black is one of the best backgrounds against which to look for this effect and the surface should be smooth, I have detected the phenomenon on many other objects of different color and composition. The gilt-painted radutor, the aluminum pointed fire plug, a copper coursilver com, a green leaf, brass acticles, black print letters, other colored parts of juctures, and even on white paper itself. It is now my per the me that the other parliable exists on all is seemed all materials whether we can see it or not -A \ \cm \crk \ \ \

There May Be Life in The Old Girl, Venus, in Spite of All

I not to thinking about this one the other day and I thought I d write you for information. Those who pretend to know tell us being has an atmosphere seventy-seven to righty-eight miles thicker than ours, and in this atmosphere they find carbon-dioxide. On being fiscif there are faint green markings

that are thought to suggest the presence of vegetation. If all this is true, is there life on Venus? What kind of life? And what does it mean as viewed from the standpoint of our development? A ewe dragging away, or are we structing



in the van? How would life on Venus fit is with evolution and the theory of special creation? Maybe, the remarkable ancients were eight and we're merely headed for another planet and more experiences. If so, how do we get to Venus when we shuffle off this mortal cod? LBT, Greenwood Lake, N V

First Class Reason Why You Should Buy Now

Newspapers, biliboards, radio orators, and the rest of the machinery for molding public opinion have been quite busy of late in a rather praneworthy effort to end the depression. The solution offered is simple. Let the public start buying and straightway business will juck up and the depression will be over Fine! You can find no more flaws in that areument than you can in a statement that if the sun rises in a cloudless sky we'll have a clear day. But the phitomal writers, advertisers, and broadcasting economists proceed immediately to trip over their own feet by urging the public to buy "as a patriotic duty My eyel says I There are two, and only two reasons for buying anything today. First, because you want or need something and have the money to pay for it, second, because prices generally are at such levels that almost anything brught today is a bargain. That's the common sense of it and patriotism, chacity, or any other altruistic motive enters into the thing not at all. The principal reason. why buying has lagged and the country is in a slump is fear, in most cases unreasoning, indepensible, fooleh fear. The head of a

business doesn't buy a new car for fear of the opinion of employes whose salaries have been reduced. His employes won't buy new clothes for fear of the effect on the boss. And so on, down the line, merchant watches customer, customer watches merchant debtor watches creditor, neighbor watches neighbor, all holding back and making what they have do" until things pick up. Pick up—how? Business can pick up only if those of us who are not entirely destricte decide to buy what we need at the present barguin prices, not from duty, not with any sense of doing a one or noble thing, but merely because it is the normal, natural thing to do.—A.L.K., Rochester, N. Y.

This Ear Language Is Hard to Master

Since reading your article "Spot Crooks by Their Ears" in the November issue. I've kept my eyes open and have spotted flap rars in the most unexpected places. One of the best doctors in town has flap ears. My

rayorde minister has an The president of one of our biggest banks has them. Not a breath of scandal has ever tourbed any one of these people. So what? Each is above the average in intelligence and I d bet my last cent they're all honest. That each are different and



an be used as identification tags. I can behave, but that one kind of ear means a crook and another kind an honest man is too much for me to swallow. Do you suppose it's posphile Dr. Kilmer is being the least bit overenthusiastic? Pioneers in other fields have exaugerated—F.P.S., Denvey Colo.

It's Possible This Old Earth Won't Explode

You can tell C.E.A., Majon City, Town that the best at the interior of the earth is caused (according to one theory) by the pressure exerted upon the center when the cartic solutified. Most of this heat is far below the heat of a volcano, so the carth heat can be chimicated. However, shriting of the earth's crust causes heat, but it is usually too slow to cause an explosion. The gas and off are under stable pressure, and cannot explode without oxygen. Most vocances are caused by sudden pressure creating steam The water enters through cracks in rocks that have been broken by earthquake. I hope I have explained clearly if not I shall endeavor to prove by mathematics or author-ity.-A H N., Mt. Washington, Obio

Don't Leave It to Us; We Don't Want Any Part of It

I'm leave it to you—ten't English, as she is spelled, a queer bird? Just go crazy with me and suppose you started out to spell the simple word "potato" exactly as many other words in our astounding language are spelled hou'd take "p" sound in count, and start with gh. Instead of "o" you write ough as in dough. You d take the "t" from patchisic, the "a" from neigh, the "t" from gazette and

the "o" from beau So you'd spell potato, ghoughphthe chiteau Not even lire and would be able to handle that take Is their lask in any sense to the manner in which we spell the words in the linguish language? And yet some people are fuses.



about following the spelling in the dictionary?
R.D., New York, N. Y

Take a LOOK at the private life of Ethyl Gasoline

ASOLINES are like people, Some are 🔾 always well behaved. Others can't be trusted out of sight

Most regular gasoline, for example, has hysterics when you call on it for extra work. It literally blows up-wastes its power in harmful knock. But you can trust Ethyl Gasoline. It always buckles down to work, de vers power with a smoothly increasing pressure that makes your car run at its best

How do we know all this? Just recently a group of engineers played detective on gasoline. Through thick quartz gass windows they snooped into its private life. With special high-speed cameras, they took photographs of the actual combustion of motor fuels

Look at the pictures below. At the left, a typical photograph of the antics of ordinary gasotine in a modern high compression engine. Compare it with the picture on the right. There's Ethyl-Gasoline burning smoothly, steadilyproducing more power and less wasteful. harmful heat.

Behind your wheel you feel this difference. Start using Ethyl Gasoline today It is a motor fuel that you can trust to give you the utmost performance of your car and at the same time protect your motor from wear and tear, excessive choking in starting and over-

heating on hard runs. Ethyl Gasoline Corporation,







Slow-motion movies of gaseline combastion



beautiful postero & the appropriate most Demoit engagement took (Associate people) of the process of people followers in Automorphy profess That westerback ENTERN HAR HARME



UNEVEN COMBUSTION of withing SMOOTH COMBUSTION of Bide Green carries. Through a quarte wandow in the multiplet. Stor. There is no trace of based bette. Note the men progress of the flatter . the greater spread of power. Filter matery is combined on delivery more power to abungement begen for whose best, It is light too the Address - windowship (44)

Buy ETHYL GASOLINE



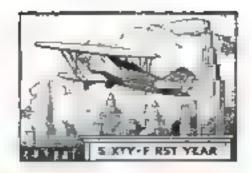
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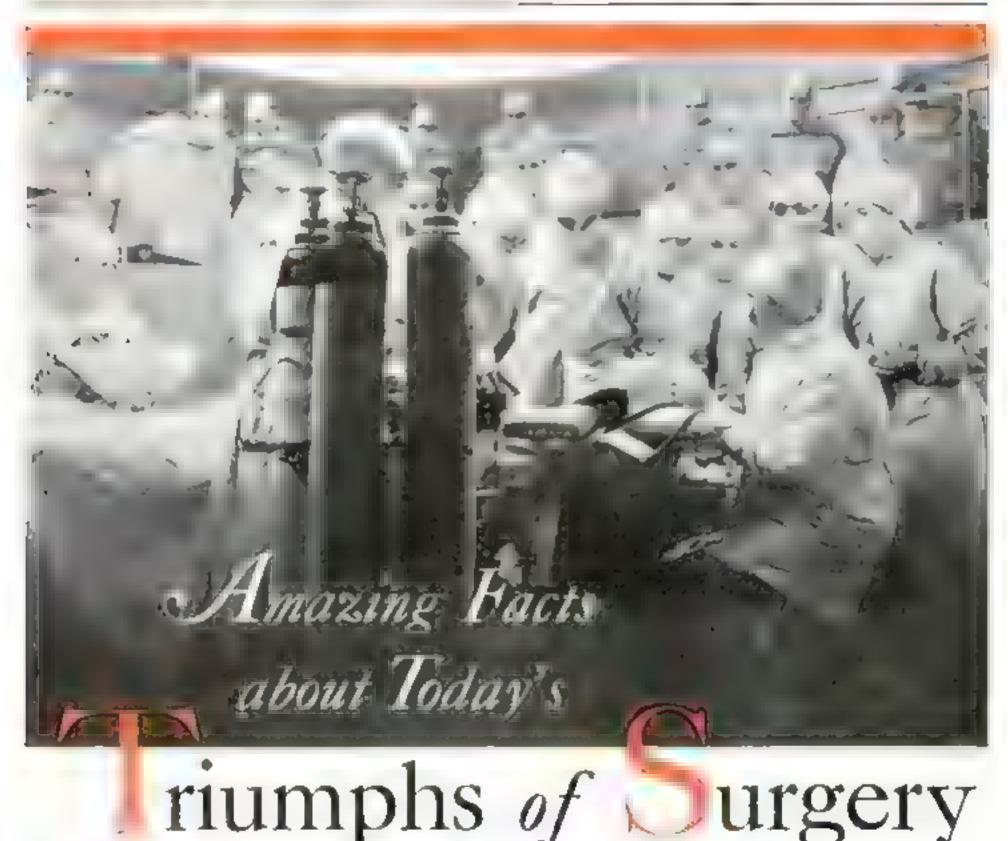
MONTHLY

December 1932

Vol. 121, No. 6







NE of the most dramatic stories of the Twentieth Century remains virtually union. This is the story of modern surgery

Tradition and ethics of the medical profession prevent the surgeon from reporting to the press his own accomplishments. A wall of adence surrounds his work. Even wellinformed persons know little of the miracles of life-saving which these white-robed figures perform behind the closed doors of the operating room.

Unknown to the general public, a revolution in surpical methods has been going on since the turn of the new century. New Enesthetics, new disinfectants, new methods of diagnosis, new mechanical aids that shorten the time and lessen the shock.

of an operation, have been developed. It is the swift moving story of such little-known marvels that this series will present to the readers of Popular Science Monthly.

With the full equipment of a modern operating room at his disposal, and with ample time for preparation, the present-day surgeon is master of cases that a few years ago were considered hopeless. But his skill and resources are tested most when he is fighting against time and tremendous odds during emergency operations. Under such conditions, surgeons are even called upon to bring back to life one whose heart has stopped!

I once witnessed a miracle of that kind in a New York City hospital. A surgeon, fighting to save the life of a young mother, had ordered an emergency abdominal operation. Al. was tense as the figure draped in white was wheeled into the operating room and lifted to the table

Drop by drop the doctor at the head of the table poured the other onto the mask over the patient's face. His fingers

never left the pulse that was throbbing behind her jaw

The surgeon cut the gleaming white flesh with a quick, long stroke of his blade. Then swift hands moved in and out of the wound, cutting, swabbing, clamping, and tying.

The first of a series of Articles describing the wonders worked in modern hospitals

By Frederic Damrau, M.D.



'The patient is doing hadly The pulse is becoming more rapid!" was the warning from the assume doctor at the head of the table.

This was the signal to finish the operation as mon as possible. Every a iditional mament under ether increased the danger. The surgical staff fought desperately against time, but the strain of the operation was too gr.

topped breathing The pulse is gone with a startled announcement

The operation was stopped instantly Down went the head of the table, in hope that reviving blood would flow

by gravity to the vital nerve centers at the base of the brain and restore activity.

The surgeon placed his hand over the heart. It had stopped! The woman's lips were dark purple, almost black, and her skin was rapidly assuming the same ominous hue.

A quick hand passed to the nurse's tray and seized a small syringe with a long needle attached. It had been prepared beforehand for just such an emergency. It contained adrenalin, a powerful heart stimulant obtained from the small superrenal glands located above the hidneys. It is used as a last resort.

Resolutely, the surgeon plunged the needle through the chest wall between the ribs lying over the heart. His thumb pressed the plunger, forcing the adrenalin solution right into the chambers of the heart itself

In less than a minute, the stopped heart was beating again and the woman had been saved. We had seen a human being snatched from death by the foresight of a

An Untold Story of Thrills

AFTER many centuries of slow development, surgery has at last joined science to art and today in no other field of human activity are so many miracles of skill and precision performed. Of the vast advance made in this field, the public knows little. In these articles, the thrilling story of modern surgery, with actual experiences from the operating room, will be told by one whose life has been devoted to medicine and who is familiar with the facts



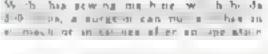
sunteon ready to fight a sudden relapse.

Had not the life-saving adrenalm been ready for instant use, the minute or two required to place it in the syringe would have made it too late. In emergency operations, split-seconds are precious, rapid decisions necessary.

One of the most remarkable cases of quick-witted daring I ever saw in an operating room occurred at the end of one of my rides as an ambulance surgeon at a New York City bospital.

On the crowded East Side, a jealous husband had shot his wife through the heart and then committed sincide by jumping from a window. The woman was deadly white, hardly breathing, when we pushed the stretcher through the miling crowd and placed her in the ambulance. All the way to the hospital, as we raced with clanging bell through traffic, she was sinking fast. I could feel her life shipping away like sand running through my fingers. Death seemed only a matter of moments,

At the hospital, the semor surgeon was



chrows no shadows had occh shapped on above the operating table. White

masks covered the faces of the nurses and the surgeon was slipping his hands into subber gloves as we entered. Hastily, the anesthetic was administered. The surgeon had one gambling chance, a thousand to one shot, and he took it.

With lightning-quick strokes, he cut down to the ribs overlying the heart. Then he chipped through the bones with rongeurs, or surgical pincers, and opened a little window in the chest wall

Within, we could see the heart fluitering feebly in convulsive final beats. We held our breath and waited for it to stop. Swiftly, the surgeon thrust one rubbergloved hand into the opening. His fingers, encircling the failing heart, squeezed steadily and then relaxed their grip in regular rhythm until the normal beat returned.

Then he steadied the heart with his left hand, and with his right sewed the wound together. The woman, given up for dead when she entered the operating room, made a complete recovery.

As the surpressions to be contact that are the created on the winds on the winds of the contact to be a surpression to be a su

y we have a right to a a a great a series of the series of

Most people tunk that an injury of the heart means cert in caudly it does. Hat we have the rescribed, will save the life of a perto even when the heart is served to eat or tore.

I remember one example, with a one of man, that occurred no or A coast A gambler was stable to a first a mother to be that an emergency operation the sat was sewed up. The operation would have been a complete success except for he put ent. No souner was he out of the tospical than he hunted up the man who had stabled him in the resulting brawline would in his heart pulsed open and used be one a second operation coald be performed.

Recen ly a queer case of to contain heart puzzled Youngstown, Ohio, surged A th recen-year-old boy was accidentain what in the these by a playmate. The ..? camber bullet pierced his heart. Yet be compained of no pain there. Instead becompained of no pain there. Instead becompained of no pain there. Instead becompained severe pains in his left leg. X-t. thoughout showed that the bullet, which had entered the heart without k link him had been pumped out and carried by the bloodstream until it lodged in the artery feeding the left leg.

Bullet wounds frequently demand unu-

sual emergency work, Not long ago, a Chicago surgeon performed an an a nig emergency operation that saved the loof a bullet-riddled to Kellet.

The gare of a just they on Market gan have when a taxicab whirled around the corner, Lead streaked from he weapons of crouching gunnen inside, and e victim, apparently d. was left sprawled a gar of twenty-ar built holes had

tines—each one likely to cause pentonitis due to the dripping of the intestinal contents. The inner tube of a tire could hardly be expected to be patched in that condition.

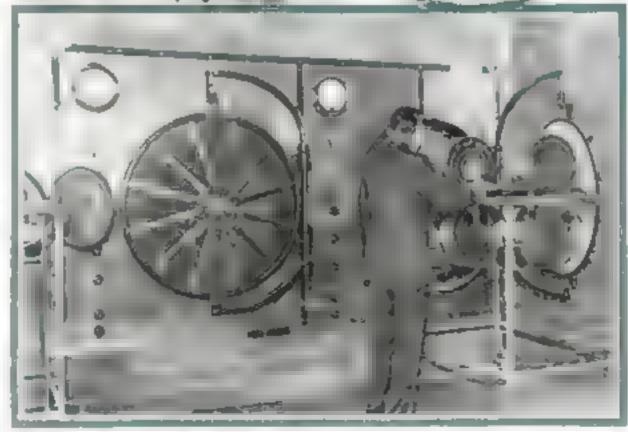
At the hospe if he surgeon exact edevery inch of he thirty feet of he intestine. A single hole let unrepaired would have frustrated the entre operation. As each perforation was discovered, the surgeon called for a special needs and extrafine silk thread and so skillfully patched the delicate bowel that one would never know where the puncture had been. In a few weeks the patient was out of the hospita.

One type of emergency operation that is always a desperate race against time is saving a person from choking to death.

Sitting near a surgeon friend of mane at a dinner party recently

a fat, bald man who was in he act of swadowing a mouthful of food when he started to laugh a riously. A piece of steak word the wrong way. He was the wrong way. He was the wrong way, he was to fine neck stood out as the word burs. The cuests turned him upsidedown and a need (Contained out page 112)

Below aperta rinow tend by



The sterlinging room of Mt. Sinal Hospital, New York, where all metraments are steamed clean

Dead Horse Lives in Marvel of Taxidermy



1 Skeleton of Phar Lap, held together with ware and stee, rode. Afterwards it was completely revered and end out with planter

ROWDS packing the grandstands at Belmont Park, famous Long Island racetrack, received their biggest thrill recently from a horse not entered in the races—a horse that had died aix months before!

Phar Lap, legendary wonder borse of Australia, rode by on a motor truck, neck arched alert ears slanted forward, chest-put coat a silken sheen. Every muscle every vein, every ripple of the skin was there. The magnificent naimal had been brought to life" by one of the most amazing pieces of scientific taxsdermy on record.

After appearing at American tracks, where he had been expected to run this year, Phar Lap is going home. In Australia he famous horse will be placed on permanent exhibition

The career of Phar Lap—whose name is Javanese for lightning and means, literally, "wink of the sky"—is one of the

most dramatic in turf history

In 1977, the huge gelding, towering above other horses at the post was shipped from England to Australia and sold at nuction for \$800. Within four years, his winnings had reached a total of \$332,250 a mark exceeded only by Sun Beau's all-1 me record of \$356,044.

In fifty-one starts, Phar Lap woo thirtyseven races and came in second three times. Before he crossed the Pacine fast winter for his American invasion, his buge lessurely stride had carried him to a secure place as one of the greatest race horses of aid time

Five attendants guarded bun day and night after someone attempted to shoot him near Melbourne, two years ago. Because he was particularly fond of rolling in a certain kind of sand, a pile was proGreat Australian
Racer, Exhibited
In Rare Mounting,
Looks Ready for
One More Contest

stable. In spite of every effort, the great horse grew steadily worse and that afternoon, with tears in their eyes, the stablemen announced that Phar Lap was dead. Acute cour is believed to have been the cause of his sudden end.

A few days later, his owner announced that he would send Phar Lap's heart to an anatomical museum in Melbourne. The handsome chestnut hide he planned to have mounted by a taxidermist.

Then the difficulty arose of finding a tandermist skillful enough to do the job. Although the skeleton of Sysonby, noted on American tracks a generation ago, had been placed on exhibition at the American

Museum of Natural History, in New York City, no one had ever mounted a word-famous race horse

On the other side of the continent, at Yorkers, N. Y., three brothers, Louis, John, and Leslie Jonas, had been doing remarkable work in preparing wild animals for exhibit, tising new methods that increased the little kness of the



2 As the next step in re-creating the famous horse, sheldton and planter were covered with acuiptor a clay in which every muscle and line of the I ve body was carried y medeled in by the sculptur

vided for him wherever he went and when he sai ed for America rading in a specially built cabin enough of his favorite. New Zealand oats accompanied him to last for three months.

In his first appearance on this continent, he walked away with the \$50,000 Agua Cali-

ente Handicap.

Then came the end, sudden and dramatic as a flash of the lightning for which be was named. He had been taken to the Ed Perry Ranch, as Menlo Park, Calif., to rest between taxes. Early one morning, only two weeks after the Agua Caliente triumph. Tommy Woodcock, his trainer, who always slept within

a few feet of his stall, found Phar Lap lying down. His owner, David J. Davis, was called from San Francisco. His vetermanan, Dr. Walter Nielsen, rushed to the

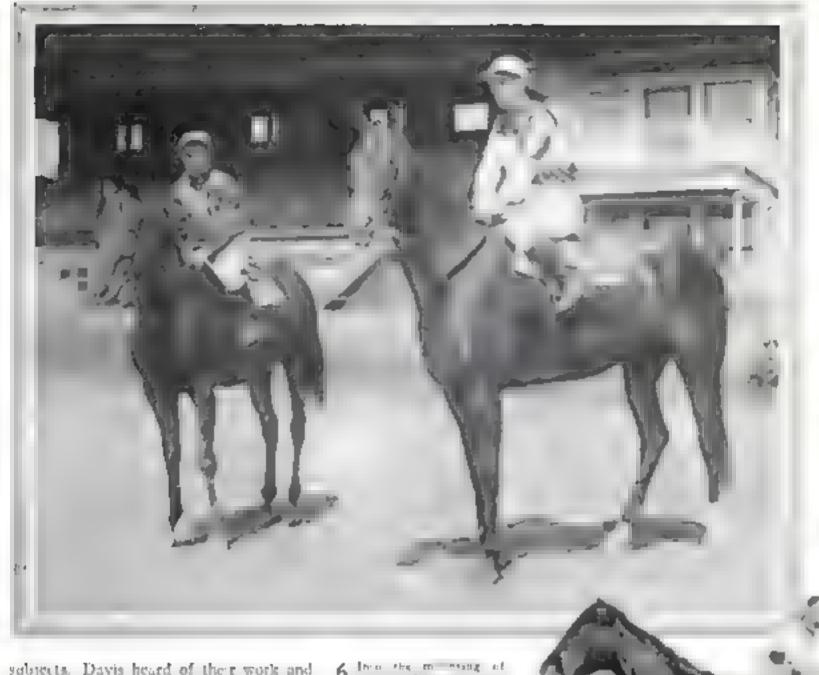


3 Over sculptor a clay was next to discouring of plaster of Paris, above When day this plaster moid was removed a sections, some of which weighed over 270 pounds



Which Horse Is Alwer

Congression and post of the end o



pa or and more real

est somewhere hell received greater name a are set and o galo

subjects. Davis heard of their work and turned he reproductions of Phar Lap over their

Twice a day for two months at the part of the work. Louis Joh and the horses in their workouts. He had the horses in their workouts. He had them in every detail, paying a standarion, a but a second the painstaiting study that presented the four and a had aworths of intensive labor required for

chirate the ark

Each section of the planter of Postfront was coated with a wex preparation, below, and stripe of paper, and or up were present along inside them

5 A ter be closer a "bir an ha de ed hey we even a free he se hone and hasled tigeths on emily a bir Tig. was able a medical tig. age? we have

7 Neve a home of the or or a. The Theory is a rear or given the second of the second o

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Plaster Cast Covers Eye as Record of Its Movements Is Made

Without fatiguing a subject, delicate reactions of the eye can be recorded with a new device recently perfected in Paris, France, by the Russian scientist and sculptor, Serge Yourievitch. A plaster cast with one eye-hole is placed over the subject's face. Pressing against the hidden eye is a sensitive air sack connected with a recording instrument by means of a rubber hose. As the eye moves in coordination with the one that looks out of the eye-hole, changes in air pressure within the sack operate the instrument which keeps a multiple graph. record of all such movements. The reaction of the eye to straight lines, circles, sources, and ellipses, is said to be important in diagnosing ocular troubles in their early stages. Yourievitch, who has been carrying on rescarches in connection with the human eveannounced to the Academy of Sciences in Paris, in 1929, his discovery that the eye moves with a rhythm of its own.



POLICE RADIO CAR HAS TRANSMITTER

dansautting sets are soon to be added to the receiving outfits of Los Angeles, Calif., police radio cars, if the necessary special permission can be obtained from the Federal Radio Commission. They will enable police cars to flash an immediate call for an ambulance if one is needed. A compact transmitter that takes up no more room than an automobile storage hat tery has been perfected for the purpose by J. G. Rosso, radio supervisor of the Los Angeles police department who is shown at left with his new set



WALKING FISH FOUND IN GREENLAND

A POUR-LEGGED walking fish, discovered recently near a Greenland I jord by Dr Lauge Koch, veteran Danish explorer, is believed the long-sought missing link through which, ages ago, fish evolved into frogs and other amphibians. Thousands of petrified specimens of the queer creature were found in one spot, apparently slain by some preinstoric catastrophe. Those brought back are reported so valuable that if sold to museums, they would pay the cost of the ninety-man expedition for three years. Scientifically Dr. Koch classifies his walking fish as a member of the family of

Stegocephati," an extinct order of salamander-like amphibians, of which he befieves it the patriarch. At the date he ascribes to its existence, it might easily have been a transition stage in evolution between fishes and amphibians, which in turn evolved into reptiles, mammals, and man, as illustrated in the sketches above

Other members of the walking fish family have been discovered before. A restoration of one is illustrated. While none of them lived sufficiently early to be a possible missing link the new fish is reported to resemble them.

STRANGE HUMAN FIGURES TRACED IN DESERT SAND

Seeking a suitable spot for a forced landing a pilot recently came upon giant figures of men and animals on the desert near Blythe, Calif Scientists are reported to be completely mystified by the discovery, and have enlisted the aid of the Army Air Corps to photograph the strange designs from the air One of the pictures, reproduced above, shows a human figure ninety-five feet long. Ground exploration showed the figures had been made by scraping away the thick surface layer of brown pebbles, exposing the soil beneath.

TAIL LIGHT ON THE HEEL



PEDESTRIANS
may walk in safety
along an unlit road
at night, with a new
tail light strapped
to one heel. Under
the rays of an automobile headlight,
its reflector flashes
a warning red signal to the driver

Biggest Autogiro Has Four-Place Cabin



Begen autogica yet bui't. It has a four place cabin and is designed for use in commercial transport work as well as lot private flying. Tests proved its a receptioness

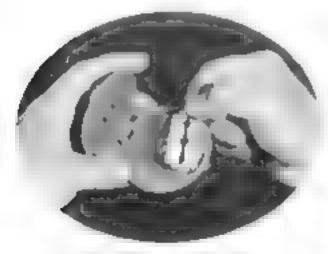
Autocines are growing up and taking on new responsibilities. Newest and biggest of the windmid plane models so far built is a four-place cabin model suitable for commercial transport use and also for private flying Twin rudders and a 400horsebower motor are innovations appropriate to he larger mae. While the latest machine in an experimental model, it is expected that its success in tests at Pitcairn Field. near Ph ladelpuia I'a will be followed by quanlity production. An odd appearance in given the craft by the high, arched roof of the cahin.

TINY ONE-MAN PLANE MAY BE AIR FLIVVER

More like a motorcycle side car than a fusciage is the body of a new baby plane recently exhibited in Germany A radiator at the front cools the motor, which is concealed just behind it, and which drives the propeller through a vertical drave shaft and a system of gears. The control surfaces of the tail are mounted at the end of a long outrigger. According to the designer, machines of this type could be sold to prospective users in the form of complete sets of parts, to be assembled at home. Only the motor propeder and fue tank would be shipped complete. Thus anyone could purchase a flavver plane at a minimum of expense, supplying the labor to assemble the parts himself. In this way the original cost of the machine could be materially reduced The designer says some scheme like this will eventually fill the air with planes.



This tiny knock-down German plane is expected to be the luture 8 ever of the a r

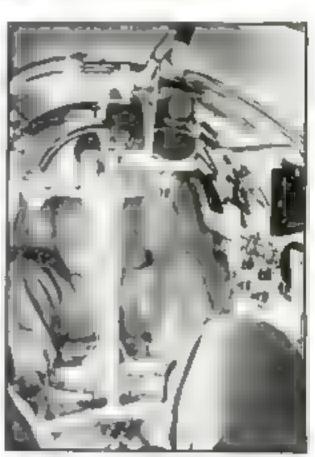


TWIN DISKS SHARPEN SAFETY RAZOR BLADE

Twin disks of an abrasive compound, housed in a metal container resembling a small vanity case provide the shaver with a new device for sharpening the blade of his safety razor. Projecting from one of the disks are two lugs spaced to accommodate the hoies or slots of the blade and to hold it in position to be honed when the case is shut and a crank turned. According to the manufacturer, a few turns sharpenthe blade.

PILOTS FACE EACH OTHER IN STRATOSPHERE PLANE

WHAT the inside of a stratosphere plane looks like in shown in the picture at the right. It is the first view to reach this country showing the interior of a Farman plane recently tested near Paris, designed to fly at high speed through the rarefied atmosphere tune miles above the earth (P.S.M., Oct., '32 p. 13). Two pilots sit facing each other in the barrel-shaped cabin, which is sealed airtight to protect them from the physiological effects of reduced air pressure at great beights. They will fly the machine blind, depending upon instruments alone to guide them except in taking off and landing. When the time comes for descent, the pilot facing the camera, in the picture, climbs into the open through a circular trapdoor just above his head. Sitting on top of the plane, he lands it by means of extended control levers, Latest plans call for an attempt at a nine-hour flight from Berlin to New York with the new plane flying at a high altitude



Interior view of the arr ght cabin of the attatosphere plane recently tested in France

ESCALATOR IN GÄRÄGE SPEEDS CAR SERVICE

WORKERS in a San Francisco, Calif., garage, with a 1,000-car capacity, can deliver a customer's automobile from the eighth floor to the sidewalk in forty seconds. This is made possible by a vertical escalator and a long camp down which cars are driven. Each worker, going for a car, steps on a tiny partform attached to an endless belt and rides straight up. To descend, he steps on the other aide of the escalator and rides down. Electrical motors keep the escalator running constantly



Vertical openiator appeads service in this garage



RACE HORSES NOW GET ELECTRIC CURE

Will electricity make a race horse run faster? So believes Dr. Robert L. Humphrey, Washington, D. C., veterinarian, who, at the Washington Riding and Hunt Club, is applying an electric cure for bowed tendons and other ailments to which thoraughbreds are subject. He employs disthermy apparatus resembling those used for human patients, which provides an internal heating effect to speed the healing of tissues in a humane and painters way, The photograph shows Dr. Humphrey treating one of his patients, while an assistant manipulates the electrical apparatus.



BULLET BOUNCER ON CAR SAVES POLICE FROM THUGS

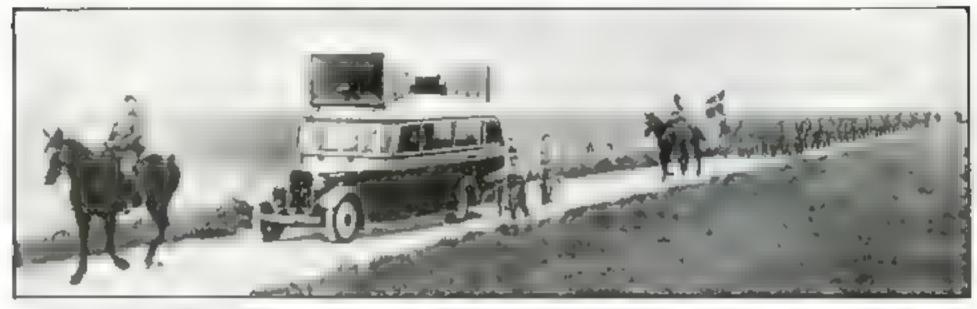
BULLET bouncers are now in use on cars of the San Francisco, Calif., police department to protect members of radio patrol crews from the gunfire of thugs. The contrivances are sheets of quarter-inch-thick steel plate, equipped with shuttered windows and hinged to the top of the windshield frame. Normally the bullet bouncer lies flat upon the top of the car, but it is lowered in front of the windshield when gangster bullets begin to whis. The windshield folds out of the way, and patrolmen fire through the narrow windows. They may also peep through a hole in the car top.



Two engines seem better than one to a Des Moines, lows, inventor who has designed a truckand trailer combination with an extra motor, The booster engine is mounted on the chassis of the trailer, complete with its own gasoline tank, radiator, clutch, and transmission. To set it in motion, the truck driver pulls out a button on the truck's dashboard. He has two gear-shift levers, one for the truck and one for the trailer

According to the inventor, the booster engine will help a beavilyloaded truck over a bill It will also propel the truck in case of accident to the truck's engine. Since the trailer's power plant is free wheeling, there is no interference with the regular drive.

PHONOGRAPH AND LOUDSPEAKER REPLACE ARMY'S BAND



Phonograph music amplified by loadspeakers on top of the car replaced the regular hand when the Danish soldiers went on a cross-country march

Will, canned music inspire future warriors? Veteran army bandmasters in Denmark were taken aback when a lumbering sound truck recently took the place of a regular band and led a detachment of Danish soldiers on a cross-country march. Martial airs played upon a phonograph were amplified and projected to front and rear by horns atop the truck. Lavely discussion was stirred up two years ago in this country when the United States Army became interested in mechanical bands to replace municians. A sound truck for this purpose was designed, built, and offered for

test by the Radio Corporation of America (P.S.M., Aug., '30, p. 48). Its volume equalled that of two Army bands and the quality of music was called as good as the average in the service. To date, however no definite move to adopt the mechanical substitute for bandsmen has been made public.

CABLE CAR TAKES TOURISTS UP 6,000-FOOT MOUNTAIN

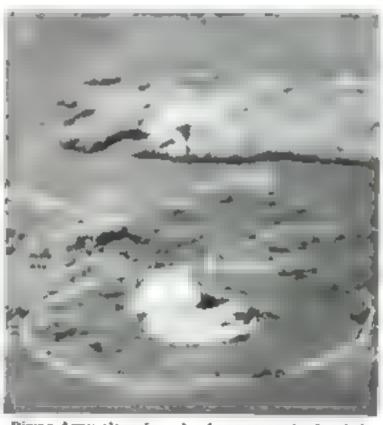
LATEST in vehicles for aerial sightseeing is an allaluminum car put in service at Engelberg, Switzerland. Its fifteen passengers are treated to a breathtaking view of Aipine scenery during a 6,000-foot ascent on cables. The precipitous climb is made practicable by the aghtness of the car's metal construction, which minimizes the power required to operate the hauling cable to which the cabin-like car is securely attacked.

ELECTRIC EYE WORKS MAGIC FOUNT

A puzzle to the uninitiated are the magic tountains" that have appeared in several cities. Water automatically spouts from one of these fountains when a person bends over to get a dries. and stops of its own accord when the user withdraws, all without manipulation qu handles or valves. There of the fire sensil tectric eve, so that anyone who stoops for a drink will interrupt a beam of light focused upon the cell. His shadow operates an electric telay that starts the water flowing



DIVING ARMY PLANES BOMB TARGET

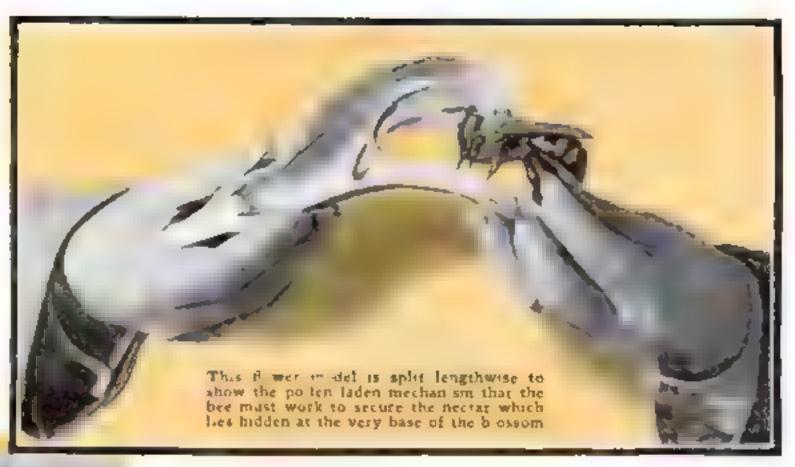


Diving Army plane drops bombe at target in the circle

DIVING out of the sky, wing-clapped pursuit planes feel at nearly 300 miles an hour in bombing practice at Langley Field, Virginia, recently. In rapid succession, they dived, stung, swooped away Each time, the ground within the white circle marking the target was torn up by the highexplosive shells they released These maneuvers are part of an annual competition for army airmen which also includes machine gun contests in which pilots, trained in the manner explained on page forty of this issue have an apportunity to demonstrate their skill.

By Gaylord Johnson

Whose Skill
Developed a
New Way to
Reveal One
of Nature's
Mysteries





Buspended by wires, a model been to held in place above a model flower while Cay-sed Juhnson photographs it for his ser as of movie pictures that abow as actly how plants are level and

BLOSSOMS are, as everyone knows, the restaurants or groceries of bees—and food is not furnished free, any more than it is in human shops.

The bee pays by becoming a messenger, she carries away a little of the vital pollen dust from the flower's stamens. It adheres to her harry cost and tongue.

Upon the sticky partil of the next flower visited some of this yellow dust as subbed off, thus asking in the cross-fertilization of the second plant's seeds.

It is plain that the bce secures her supplies of nectar in return for performing this messenger service. To make sure that it is properly carried out, the flower hides its drop of nectar far behind the polleuladen stamens. The bee must pass them and receive her poilen dust for delivery at the next flower before securing the honey.

Everybody understands this general plan and its operation, but almost everyone is ignorant of the many amazingly ingenious mechanical devices flowers have

Movie Models show HOW BEE

In her to with the messenger work, he her to with the messenger work, mechanisms plain, the writer hat upon the idea of reproducing these devices, and the bee itself, as workable scale models.

The models were made from a self-selfting modelling clay that becomes as hard as stone when dry. After drying overnight, the models were painted in natural colors,

The bee's legs were made from papecleaners, and its wings from bristol board. The short stiff hair was represented by thin grass stems stuck into the wet clay and then clipped off close to the body. The long flexible tongue was fashioned from a narrow strip of cloth adhesive tape. When painted in tones of black and white enamel, the grant three-inch bee looked surprisingly

realistic as the photographs show.

The first flower model was made to represent a single blossom of the sage which is so often found in old-fashioned gardens. The bloom is shown spirt lengthwise through the middle to reveal the mechanism the bee must operate in order to secure a drink of the nectar stored deep down in the flower's heart behind the stamen.

When the models of bee and flower were brought together and made to go through the various stages of the visit, the mechanical ingenuity of the lever mechanism worked by the bee became strikingly apparent.

All the acts required of the becfor the sage flower's fertilization are revealed in the sequence of pictures of the movie model shown at the top of page 25.

In the first picture, the bee is approaching one of the more recently opened binsooms. These are found near the buds at the top of the flower stalk.

In the next picture, the pressure of the person of the person of the curved lever has brought the oval pollen box down over the bee's back and wings,

In picture 5, the bee's continued movement has the box, full to bursting, upon her back. Many grains are spined out and adhere to the hairs,

Then we see the bee heading for an older flower at the base of the next apike of blooms. Notice how the slender forked pistif has lengthened and grown down into

Even the Bee's Tongue



Two flower forms of Quaker Lady. Left, flower I with about pistil and high pollen bures. At right, flower with low palley bures and long pistil

Bee Forced to Work Strange Trap to Get Nectar



2 Which undeveloped pixtal lies close to petal so that contact with it is impossible



2 Pressing into the flower, the ber's head has come in contact with the lever that, when pushed back, lowers the pollen box



3 Foreign its way in to reach the eacter Note how the movement of the lever has lowered poilen how until it touches bee's back



4 Covered with police dust, the bee approaches an older sage blossom in which the developed pistil hange across the entrance



S Note that in order to reach the benery, the bee is forced to pass beneath pratil thus covering it with the police dost



6 with same of the polish stall clinging to its back, the bay leaves the flower it has just fertilled and continues the cycle

EARNS ITS HONEY.

the position needed to wipe the dust from the visitor's fur as she enters.

In the next view this wiping is taking place. After securing her nectar, the bee will depart, as shown in the last picture, leaving a few pollen grains sticking to the forked stigma of the long pistd. These grains there travel the whole length of this slender curved filament to the ovary of the flower, where they fertilize the seeds at con a ns.

Once more the bee may enter a younger, higher-up flower on the stalk. Again the lever will come down and powder her back and so the cycle continues all day long. Every morning, new flowers open from the buds at the top of the stalk, and every night the fertilized pider flowers at its base wither and droop, after their

clever mechanism has accomplished its purpose of insuring fertilization.

In the pictures of the Quaker Lady at the bottom of pages 24 and 25, another astonishingly simple invention is shown in operation.

First are the two different forms of the slowers. All the blossoms on one plant will be built on the pattern of the model at the left, with a short, forked pistil and high-set policy boxes. Another plant, perhaps growing some distance away, will be found arranged on the plan of the model at the right, with low-set policy boxes and a long pistil. Both models show the flowers split in two lengthwise.

In the next picture, the bee alights upon and has her tongue powdered by a flower with the high-set pollen pads. Then she is seen in trans I to a flower on a plant of the other type, which she reaches and probes in the last picture I on will see here how the poilen, acided by the high boxes, is rubbee off upon the high pists, while more is added lower down by the low boxes of this flower

And her surprising example of nature's ingenuity is found in the flowers of the harberry shrub which hang down in long clusters. The young flowers open as little golden beals just a love the juds. Higher up on the cluster are the older flowers, In the young flowers, the pistal stands alone, with the MX stamens resting in the hooses of the surrouting penis In the lower end of each stamen is a pollen box. closed with two ear-like lids. In the art flowers, these lids are open. When a beealights on one of the old flowers and probes with its tongue for nectar, the pollen boxes suddenly slap down toward the pistal and pollen is spilled all over the bee's tongue and face. If the bee then goes to a young flower, it will inevitably rub off some of the pollen on the toothed edge of the disk at the end of the pistil and thus fertilize its seed.

Flower mechanisms are almost infinite in variety, but the main ones can be grouped under about twenty-five types. Those described are among the most interesting and ingenious that the writer has so far been able to discover and investigate. Simple field observations on the part of the reader will reveal to him astonishing flower mechanisms, perfectly adapted to aid the plant in perpetuating its species.

Must Carry Pollen from Flower to Flower -



2 Bee on Quaker Lady Sowgets police on his tongue



3 With its food of pollen, the bee seeks another flower on endless boney quest



4 Finding, by chance, a flower of the second form, im tangua deposits police

Tear Gas Gun on Wrist Is Fired by Finger Ring Trigger

Picture, below, Illustrates the manner in which tear gas gun can be used merely by raising the arm and bending the wrist



Tear gas gue on wrist with leather hand to protect thin and catgut string running from ring to trigger to discharge the gun

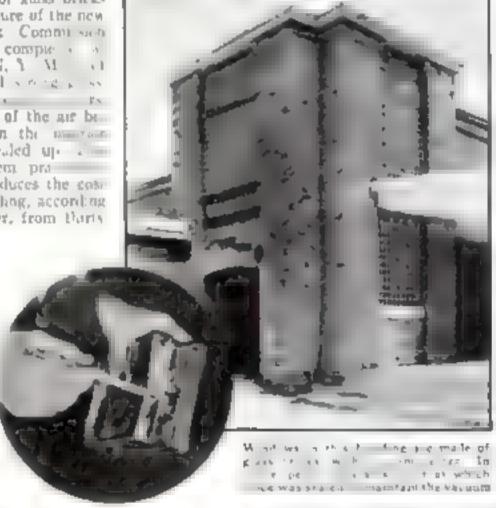
Shor by a trigger wom as a finger ring, a wrist gun that belches out clouds of tear gas has been designed for the protection of clerks, cashiers and payroll messengers. The little gun, with its music pointing forward, is strapped to the wrist where it is ind-den by the coat sleeve. A thread of flesh-colored catgut, invisible at a glance, connects a ring worn on the second finger with a trip that releases the gas. The hand can be moved about free-

ly, but when the wrist is bent suddenly at a sharp angle, the gas is discharged. To protect the wearer's arm from being humed by the gas, the skin under the muzzle of the gun is covered by a wide band of leather. A retired Chicago, Ill., policemen is the inventor of the new anti-holdup gun.

VACUUM GLASS BRICKS CUT HEAT LOSS

Windows made of glass bracks form a striking feature of the new Long Island Park Commusion building, recently complete to Sunken Meadow, N. 1 M of anusually clear and some state bracks have very less the bracks have very less the bracks have very less the manuscript from the manuscript before they are scaled up feature makes them prassund-proof and reduces the comof heating the building, according to the manuscripter, from thems

to mixty percent. In the average buildings, tests are said to have shown, more than half the heat lost passes out through the window panes. The use of the new glass vacuum bricks will cut this to practically nothing, it is reported.





BOMB-LIKE SMALL SAFE IS SET IN CONCRETE

Latest protection for valuables in the home, store, or office is a safe that looks like a bomb. Made of special metal, developed after several years of research, the spherical safe, according to its makers cannot be broken or drilled through. It is butted in the concrete of a floor or wall with the top containing the combination lock, procruding above the cement V-shaped legs admit steel reenforcing bars which are also embedded in the concrete

TAIL LIGHT SHINES ACROSS CAR



NARROW BRIDGE CARDS HAVE CONCAVE EDGES

PLAYING cards of the narrow bridge size, with concave edges, have made their appearance. The new shape, it is said, makes it easier to hold and play a hand of thirteen cards. The unusual cards can be shuffled and dealt, according to the maker, as readily as an ordinary pack.



AN AUTOMOBILE tail light, resembling a neon tube, has been developed by an Indianapolis, Ind., Inventor, The streak of red light, running across the car is easily seen from any position in the rear and it also outlines the width of the vehicle. This is especially desirable in the case of unusually wide buses. The light is tubular in shape and from fifty-four to ninety inches in length. Two standard tail light bulbs, which are placed inside the tube, supply the illumination.

Auto tail light, running across entire rear of car, shows a long red streak which is easily seen. Close-up, above, outlines the atreak of light which comes from two concealed that light bushs

Realistic Indoor Golf Game Gives Chance to Use All Clubs

NOLF matches may be played indoors, using the timbs that would be employed outdoors, with a new machine that will fit in a twelve by fourteen-foot room or a one-car garage, When a ball la driven from a mat against a canvas backdrop, the distance the ball would bave gone on a regular course is registered upon a chart. Unseen mechanism, actuated by the impact on the canvas, propels a small ball upward across the chart and stops it at the exact point to indicate the yardage of the player's shot. Four such individual indicators are provided, allowing four persons to play. When each has noted the position of his half after his drive, be selects the proper club to play his second shot and makes the stroke exactly as on an outdoor course Again the ball-shaped indicator moves upward to show where the ball would and. At the conclusion of each hole, a few turns of the rober-mounted chart expose a fresh section representing a new bole. This may be regulated so that the exact distances and conditions of any desired course can be reproduced at will. Experts who have tried the device say that all shats, from the longest to the shortest can be prayed with assurance that the



Yardage made with indoor gull char appears on scale shows in unlarged drawing at right

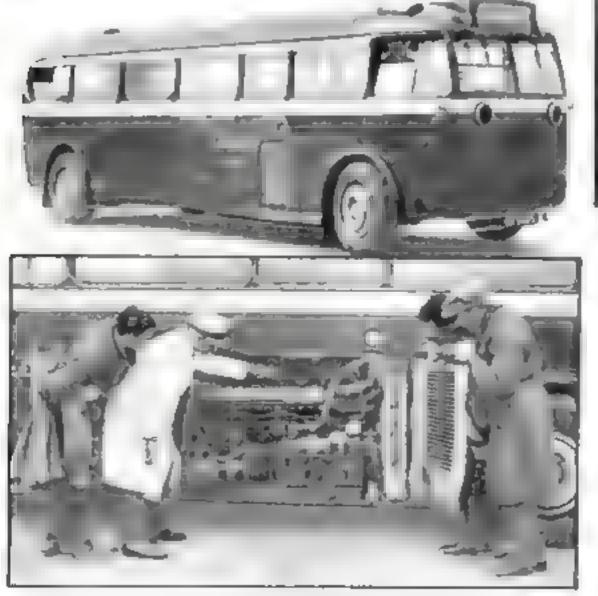
precise distance the half would travel (final players on a real course will be registered on the chart. The apparatos is so com-

part that r is satisfied no, only for golf casts or schools, but for practice in the home as well

NEW BUS HAS ENGINE IN ITS SIDE

Destance to provide maximum space and comfort for passengers, a new type of motor bus, with the engine concealed in the right aide of the body recently made its appearance on the streets of London, England. The innovation allows the full length of the coach to be utilized

for carrying passengers. In addition, the new position of the motor makes it easily accessible for repairs or adjustment. In the type at present in use the passengers enter and leave the coach through a rear door



Two views of the new London but that has its engine set in the side so the entire length of the cer con be used for passengers. Also, engine is accessible for repairs



WORDS APPEAR ON SCREEN AS FAST AS THEY ARE WRITTEN

As they are written, words are thrown on a screen by a new projection apparatus developed in Germany. It enables a fecturer to illustrate points by drawings or writing without turning his back to his audience. The writing is done on an illuminated sheet of cellophane at the center of 4 horizontal desk. Light, directed apward from underneath the sheet, passes through an enlarging lens to a tilted mirror that casts the magnified image on a wall agreen.

A turn of a knob moves the transparent strip to provide clean space for additional writing. The strip may also be rolled back at any time to diagrams previously used. To save time during a tecture, especially difficult diagrams can be drawn on the sheet before the meeting and moved into place when desired, Lantern slides can also be thrown on the screen by laying them over the illuminated space. Notes can be made to appear on the sides without damaging them by writing on the cadophane, over which they are placed



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Why, astronomers have asked, are the

DOMEST AN ATOM
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ON A RADIUM DIAL WATCH
UNDER A MAGN FYING
GLASS IN THE DARK



more distant objects moving faster? Why does the motion always seem to be away from us? If the motion is one of simple expansion, why should we find ourselves so nearly at the center, looking outward?

Exponents of the theory of relativity have been inclined to accept the view that the universe is actually expanding. But the apparent central position of our earth, they believe, is an illusion, that may be illustrated by an analogy. Suppose that, during the right, the earth were to double in size, while everything upon its surface were to remain unchanged. In the morning you would awake to find that your neighbor, who previously lived only

fifty feet away, was now one hundred feet away. The Smiths, who lived a mile away, would be two miles away. In every direction, there would be an apparent withdrawal, which would be greater for more distant objects. Everybody would be similarly affected and each would believe himself to be the center away from which the other objects had moved.

The case of the universe is analogous, except that the expansion, being of a three-dimensional volume, cannot be visualized. The phenomena are, however, comparable, The nebulae are not running away from us. Their recession is due to expansion of space, This may, perhaps,

The hypothesis, however, is not without difficulties. The expansion is so rapid that, going back only ten thousand imilion years, we find the stars more closely packed than automobiles are in Times bequare in New York City at the theater hour. Ten thousand milion years may seem too long to cause us to worry about parking places for prehistoric stars. Nevertheless, geologists tell us that the earth is at least a billion years old and we have come to regard this period as but a minute fraction of the entire lifetime of the universe. Hence the difficulty!

In a sense, this belief is a heritage from the nineteenth century. The great French astronomer, Pierre de Laplace, suggested that the sim and planets might have condensed from a (Continued on page 105)

Build Big Harbor Three Miles at Sea

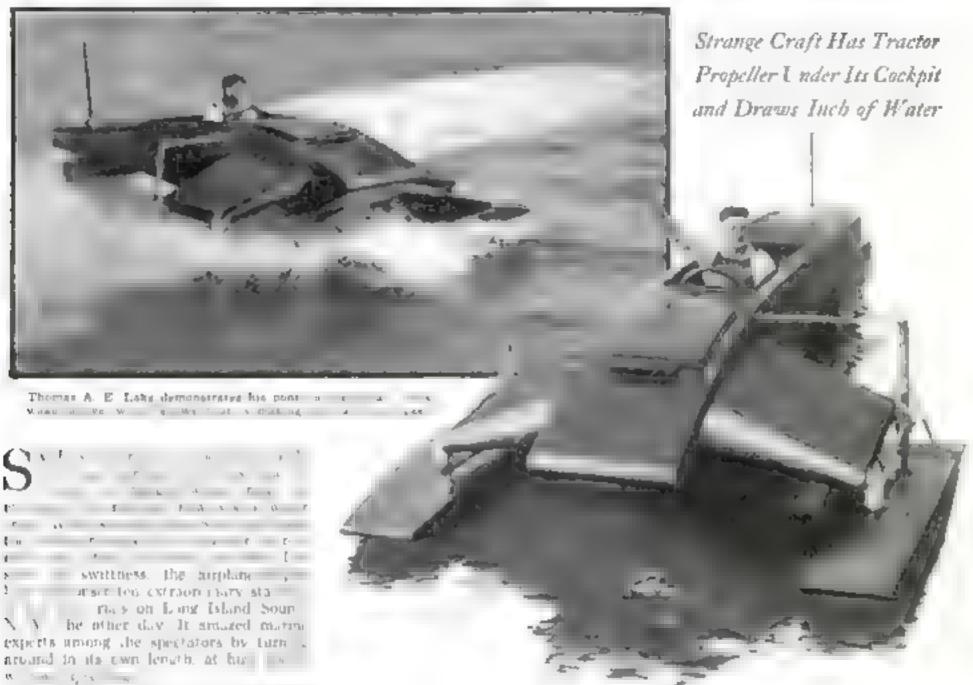


Upper view highthouse at end of the present Los Angeles barbor breakwater. Above, all view of dredges filling in the for warehouses.

tinue along the line of the first, leaving an opening 2,000 feet

wide through which ships can enter the inner harbor.

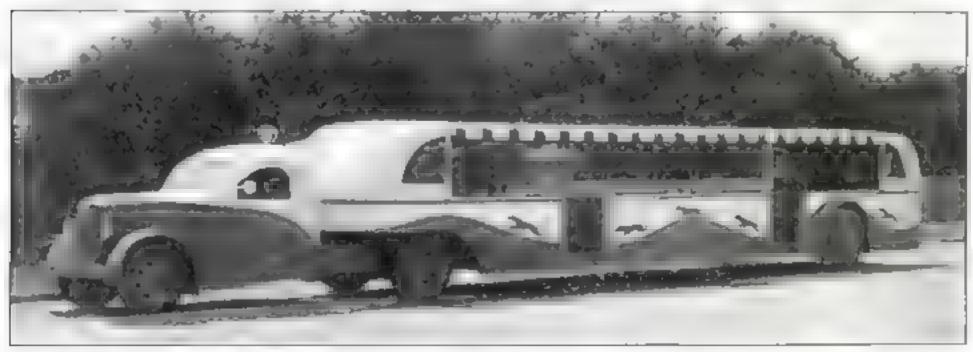
Pontoon Boat Aims at 150-Mile Speed



The inventor, Thomas A. E. Lake, son of Samon Lake, famous builder of submannes predicts that his superspeedboat will banish risk and discomfort from two-mile-a-minute water travel. It skims the surface on three pontoons equipped with shock-absorbers drawing only an inch of water when in motion. The wine span of the forward pair of pontoons accounts

for the craft's stability. When the helmsman turns the steering wheel, the rear pontoon pivots to serve as a rudder Meanwhile, through interlocking levers, the forward pontoons are automatically banked to aid in rounding a turn. A tractor-type propeller, beneath the center of the twenty-one-foot graft, pulls it along. The whole next rota es about this cen er when a turn is made. A thirty-five horsepower outboard meter was used in the experimental trials, and installed just in front of the pilot's seat so the hinged propeller shaft could be drawn up into the cockpit,

SIXTY-FOOT BUS TO CARRY VISITORS AT WORLD'S FAIR



Sixty feet long, but able to turn in its own length, is a bus designed to carry vasious about the grounds at the Chicago World's Fair, next year Of a semi-trailer type it will accommodate fifty scated pas-

sengers and forty-five standing. A fleet of sixty of the machines has been ordered at a cost of \$300,000, Two of them are already in use at the fate grounds and another will soon start on a tour of the

country, carrying a ministure reproduction of the World's Fair as it will appear when ready to be opened to the public The tour will be for the purpose of advertising the hig attraction

Giant Light and New Apparatus Used in Study of Coast Beacons



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QUIET ELEPHANT USES LITTLE ENERGY

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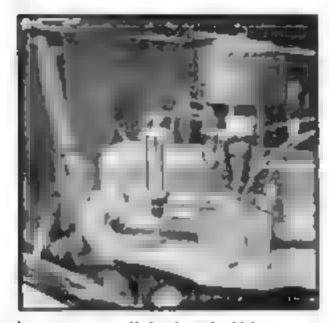


FIRE ALARM BOX PUTS HANDCUFF ON USER

A NEW fire slarm station, recently demonstrated at St. Louis, Mo., automatically snaps a handcuff on the wrist of one who turns the key. To sound the alarm, it is necessary to insert the arm in a metal aceve beneath the box. As the signal is sent in this sleeve clamps to the wrist of the sender Although he cannot remove the sleeve, the person who sounds the alarm is free to return to the scene of the fire When the firemen arrive, they remove the sleeve by means of a special key

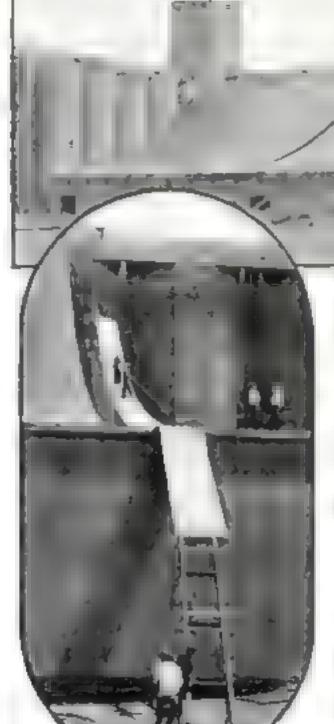
MILES PER GALLON OF GAS SHOWN ON GAGE

How many miles are you getting to the gallon? A small gage attached to the steering post of a car, illustrated above, will answer that question at any moment during a drive, according to its manufacturer, The meter employs a small, upright tylinder through which the fuel passes on its way to the carburetor. The pressure of the flowing gasoline causes a piston in the cylinder to rise. The greater the flow, the greater the pressure and consequently the higher the piston moves, Electrical contacts, made by changes in the position of the piston, move the steering-post gage needle along a dial numbered from one to five. The speed indicated on the speedometer divided by the number indicated on the gasoline-flow gage will give the motor performance in mues per gallon. For example, if the speedometer reads 30" and the flow meter "t," you are getting thirty miles per gallon. The gage is foolproof, the maker claims, and is accurate to a fraction of a gallon in its measuring of amount of gas used



Arrow points to cylinder through which gas passes on way to cerburetor in my re-per-gallon date

STEEL STRIPS FORM SUSPENSION ROOF



Above, housing 140.7 a cc a r

Suspension roofs, just erected upon four New York State grain elevators at Albany, N. Y., present an innovation in building methods. Dispensing with columns and trusses, which would have reduced the available storage space, they are entirely self-supporting. The roofs were formed from strips of steel four feet wide, welded together in 140-foot sections, Each section



Relow, operators top welding the grant paid

in turn was raised into place with the aid of cables and a boating engine, and bolted fast at top and bottom. When all the strips were installed, welders joined the overlapping edges to form a solid roof of steel, that sage in the shape of the cables supporting a suspension bridge but which is said to be able to sustain a greater weight than will fall on it.

BOAT RUNS ON ROLLING DRUMS

A next that runs along the surface of the water on drums was given a trial recently on the Hackensack River, near Newark, N. J. Five specially-designed white steel drums, having indentations like the treads on tires to increase their grip upon the water, support the craft. The free-rolling drums reduce the resistance of the water and are expected to permit high speeds with low power. An airplane engine and propeller drive the boat, which can be run up on the shore. During the experimental runs, the body, which will accommodate several passengers, was not attached to the framework.



Five freely revolving smel drams support this boat on the surface of the water

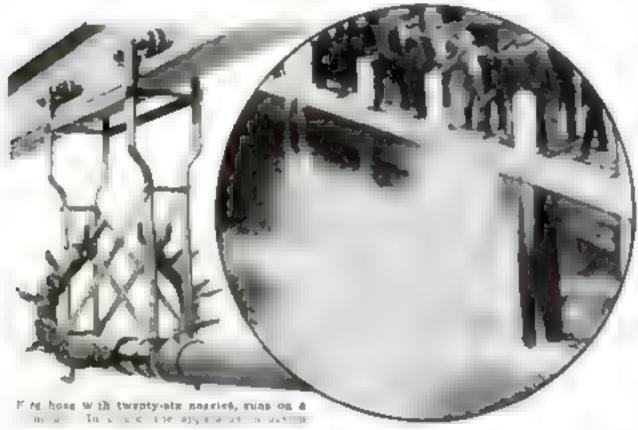
CHILDREN RIDE TINY GAS-ELECTRIC TRAIN

COMPLETE in every detail, a miniature gas-electric train that carries passengers, has been built by a British ratiroad man at Sherringham, England. The tiny coaches, made to scale, reproduce arge ones used on the railway for which their builder works. A smal. gasoline engine runs the generator that supplies electric current. A circular track accommodates the model coaches in which children ride as passengers. Three months were spent in building the system.

> Model gas electric train, compiete in a liderated dunt on a circular track and has coaches large enough for chi dran to ride in

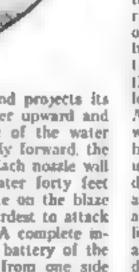


HOSE ON TROLLEY TO FIGHT PIER FIRE



Pica fires are now fought with a hose that runs on a trolley and a nossle that shoots out twenty-six streams of water under high pressure, Hitherto fires beneath steamship piers, such as recently destroyed the Cunard Line pier in New York City, have been almost impossible to stop once they got under way. The new apparatus. recently demonstrated before New York fire officials, commute of a monoral at tached under the floor of the pier and carrying, on a wheeled supporting framework, a curious multiple nozale which looks

like a twisted tree root and projects its twenty-six streams of water upward and to the rear. The pressure of the water drives the mechanism slowly forward, the hose playing out behind. Each noisle will lay down a barrage of water forty feet wide which will concentrate on the blaze at the point where it is hardest to attack with ordinary equipment. A complete installation would include a battery of the monorail nozzles running from one side of the pier to the other at regular intervals to reach all parts of the pier





CAR'S ALCOHOL CAUGHT: PUT BACK IN RADIATOR

A simple apparatus has been designed to prevent loss of alcohol from automabile radiators during winter driving. It consists of a condenser tank attached to the pashboard under the hood and a long rubber lube, one end attached to the bottom of the tank and the other shipped over the lower end of the radiator overflow pipe Alcohol, having a lower boiling point than water, turns to vapor first. As the alcohol boils off during a long run, it condenses in the tube and is carried into the condenser tank. After the car has atopped and the motor cools off, the alcohol vapor above the solution in the radiator becomes liquid again, This produces a vacuum, and air pressure forces the alcohol in the condenser tank back up the pipe into the radiator where it can be used over and over with little appreciable loss.

✓ GROW 5,000 PLANTS IN SIX-FOOT HOTBED

A rive-politan electric hotbed, with eight twenty-five-watt sums supplying beat and light to germinating plants, has produced interesting results in the Westinghouse laboratories, at East Pittsburgh, Pa-Five thousand plants, representing fifty different varieties of common garden flowers and vegetables, were produced in the six-by-four-foot bed at an average cost for electrical energy of less than onethirtieth of a cent each. This is about the same as the cost of delivered manure, ordinarily used in hotbeds, but the electric

method has the important advantage of automatically maintaining an even temperature as it has a thermostat control. During tests, last spring, the outside temperature dropped as low as sixteen degrees F., but the eight lamps kept the interior of the bed at fifty degrees, On n miniature scale, they duphrate the effect of the sun, by providing heat and light



In this six-by-four foot hothed, 5,000 plants were grown at a cost, for electric heat, of one-thirtieth a cont per plant

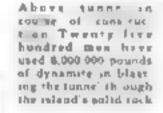
World's Longest Water Tunnel

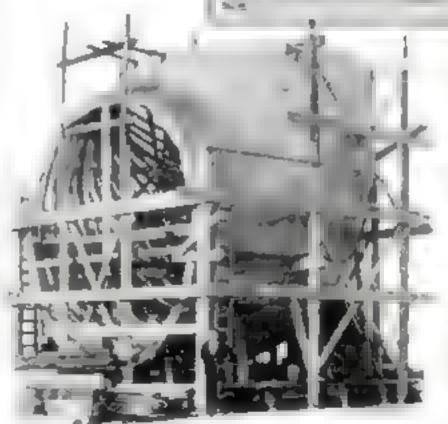
Twenty miles long and over fourteen feet in diameter, the world's biggest water tannel, a completed section of which is shown at the refer is nearing completion and when furthed will help carry a bill on gallons of water to New York City homes and factories every day

FAR beneath the feet of tramping milbons the longest tunnel of its kind in the word is rearing completion in New York City Twen y miles in length, it will help distribute a bidion gallons of water a day to New York homes and factories Othesally the shaft will be known as City Timnel Number Two, Cay Tunnel Number One, completed fifteen years ago, has long been overtaxed. Hence 2 500 workmen have been toiling day and night for the last three years to construct the supplementary lunnel, To cut it through solid rock, they exploded 8,000,000 paunds of dynamite. Bust ing went on twenty-four hours a day wi hout disturbing surface dwellers, although the tunnel runs beneath one of the most densely populated areas in the world, A railroad train could be driven through the new fourteen-foot shaft

PHOR DAN Mill sports explicate and

Rentarkable air photo of New York City showing the new tonnel, and the old, forming a loop around city Water may be sus through both or either of them





Within the wooden cage above the Bucyrus Erie compressed are shovels were tested at the factory to be sufe there was room for them to work in tunnel. They can pick up a load, awing around, and dump it in the cara standing behind them

This gigantic wooden form, left, was used in casting one of the bends in the concrete ining of the tunnel. Workman in foregrated gives idea of tunter's great axy

· Find Mysterious Error

New Rate
Varies from Old
by Fifteen Miles
Per Second

By John L.
COONTZ



WATCHING THE MIRROR SPIN AROUND This is a view of the control house at the end of the mile long vacuum tube. A. A. Michelson is seen in front of the ravo ving mirror accurring date in his effort to determine the unsel speed of light. For one house duting the tests, he occupied this position, hardly for a second taking his eye from the mittor, At left, one of the eight orded mittors used in making capatiments

XEEP LINE 1 EVEL
TO INSURE ACTURACY
So accurate measurements of distance between two

ROM the world's largest vacuum tube, stretching like a mile-long arrow over the flat floor of a California valley, near Santa Ana, has come a mystery that is puzzing scientists. Built by Dr A. A. Michelson, famous University of Chicago physicist, shortly before his death last year, the \$50,000 tube was designed for super-accurate measurements of the speed of light

Five years ago, Dr. Michelson flashed a beam back and forth between mirrors, mounted on twin California peaks twenty-one miles apart, and clocked light's speed at 150.254 miles a second. The possion y that slight abinimers" in the atmosphere had caused minute discrepancies in the results, led him to construct, with the aid of the Carnegie Institution of Washington, D. C., the 100-ton corrugated steel tube. From it, powerful pumps, working forty-eight hours, extract the air so that multi-sided mirrors, spinning at high speed, can shuttle back and forth a ray of light in what is practically a vacuum.

To determine the exact distance from spinning mirror to spinning mirror, the U. S. Coast and Geodetic Survey sent Commander Clem L. Garner to Santa Analtainer was the man who measured the distance between the peaks used in the earlier experiment. Beside each end of the steel pipe, he placed a stone marker and then began his painstaking, exact measurements. When he had finished, Dr. Michelson and his associates. Dr. F. G. Pease, of Mount Wilson Observatory, and Fred Pearson, of the University of Chicago, set their instruments up within the tube, exactly on line with the markers.

Working only at night, when the heat did not distort the glass of the delicate revolving nurtors, they began their tests, flashing beams of light back and forth down the long black tube while recording apparatus clocked their near instantaneous passage. Five thousand

thosen points be in the study

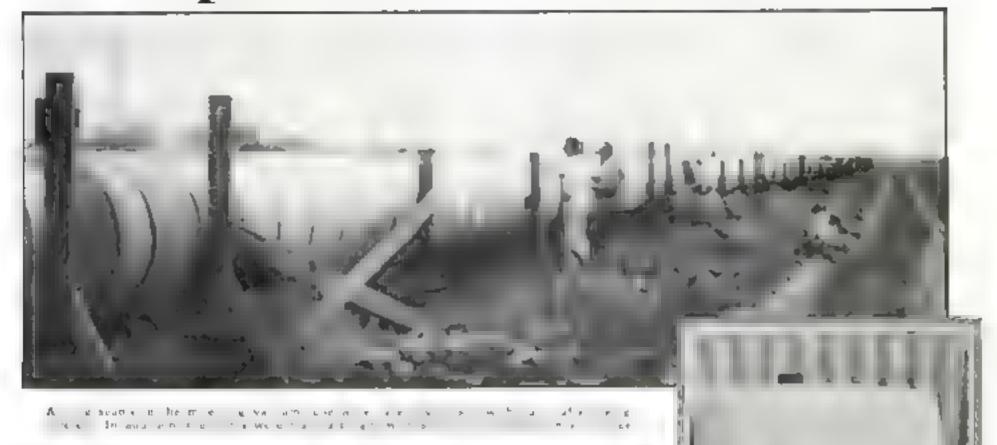
of light velocity, that platforms were raised in valleys to

maintain the right elevation

At right, concrete musker from

which the Loe was measured

in Speed of LIGHT ·



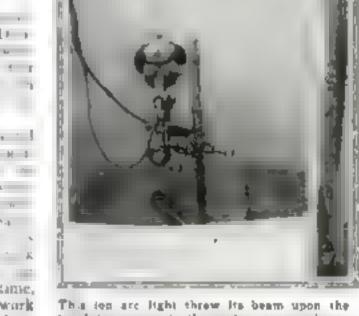
, mes they repeated the experime bed daring Dr. Mis a second

Then a reverse e t r l is is . I gures obtained a few years ear ter on the futin ain peaks showed they distered by offeen mucs a second

What was the cause of the starr r pancy? Were Garner's 1 wrong? An SO's o Washington Frough E B La ban from the Cos - Com c Survey tould and narker to marker and found the ments correct. If d the testrumen's heer dated in he take out of the with the markers? Teng showed they had not. Had the distance between the mountain peaks. used in the eartier experiment increased or decreased through earth movements between the time the measurements were

A a R a PARTY PIE PAREN to (a) why to b 1 - 4 - 11 -

> fraction of a nuclimeter. At the same time, Dr. Pease who has taken up the work had down by Dr. Michelson, as checking every possible source of error before oeginning a final group of 18,000 tests.



tevolving mirror in the control room whence It was reflected into the vacuum tube where other mirrors tossed it back and orth un ! it returned at last to the revolving mirror

SMALL ARMY TRACTOR WHIRLS BIG GUNS INTO ACTION



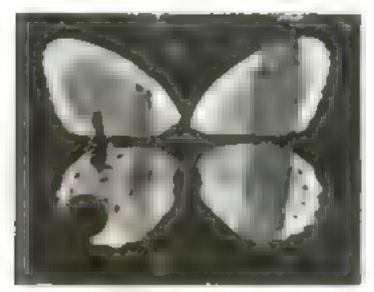
ARTILLERY goes into action faster than any team of horses could drag t, when it is whaled around the field by this British tractor, Great mobility for all weapons of war, even the largest, a now the aim of all army engineers. It is in me with this idea, that fast tractors and tanks have been developed for the purpose of moving held pieces. These tractors not only are faster. than the horses they replace but they are able to cross terrain where borses would have been stalled. Recent maneuvers have demonstrated the tractor's marked superiority, Note the machine's low center of gravity and fast running tread

Dr Eugene H. Eising, New York surgeon, espesing to unra-violet light ordinary petroleum felly. It receives its curative power as it slides down the inclined sheet

How
Strange Chance
in a
Doctor's Office
Revealed



Mystery RAYS that



This photo was made by strange rays that come from wings or burnerity. Note rays passed brough as impleme attrophet by glass disk and quarts. Piets esposed for twelve days

MIDDLE AGED man walked more to a New York surgeon's office for examination of a wound, a few months ago. For a whole year following an operation, the wound had failed to beal. Repeated treatments by practically every method known to medical science had failed. This time, the surgeon's manner after examination conveyed no optimism.

The most be could do, he said, was to send the patient back to the hospital for an attempt at a cure by another operation "Except—there's just a chance—" His eyes, glancing idly about the room, happened to fall upon a test tube hanging on a curtain

He unhooked the test tube, and emptied its jelly-like contents into a surgical syringe. Despite difficulties in handling.

the warm jelly was applied to the wound and covered with gause

Five days later the man returned. "Doctor." he said. "I think my wound has closed." It had. By some apparent miracle, a test tube of ordinary petroleum je ly, taken on the vaguest chance from in front of an ultra-violet lamp where the surgeon had been using its natural fluorescence to test the strength of the rays, had succeeded where the best remedies known to medicine had faued.

It was thus that Dr Eugene H Enang, New York surgeon, discovered an entirely new kind of bealing agent. This irradiated petrolatum, or tayed petroleum jelly, has strange attributes. Its action combines a general healing effect and a positive germ-killing

quality the latter effect differing from standard amiseptas in being a prolonged, raber than an instantaneous, action 5 rangest of all, the preparation's curative power seems to depend upon an invisible mystery ray that comes from the jelly, a phenomenon demonstrated by the rays ability to fog a photographic plate in total darkness

Even though the working of the mysterious jelly is still not fully understood, it is considered of great importance to the public. A large manufacturer of pharmaceutical preparations is compounding it already under the name of "radolatum"—short for irradiated petrolatum—and at this writing, it is available to physicians. Now plans are being made to introduce it to the general public, and drug stores

may have it on their shelves by the time this appears in print. Radout am eventually passed because a standard temedy in every household medicine cabinet. Tests in some or he country's foremost clinics show as a making versatility and effectiveness in treating such everyday ailments as burns scalds, bods, and sunburn, in addition to more serious surgical cases.

If such everyday wonders as X-ray tubes and ultra-violet lamps still impress the layman, what is one to say of Dr. Eising's preparation and its mystery rays? Or of a newly-announced process that physicians may soon be using to fight cancer, in which ultra-violet rays are generated deep inside the human body? Or, again, of strange invisible rays for which no use has yet been found, such as come from the wings of butterfises and print their image upon a photographic plate? Here are vivid examples that, so far, we have only scratched the surface of a whole mysterious range of radiations, and that new wonders may follow their barnessing

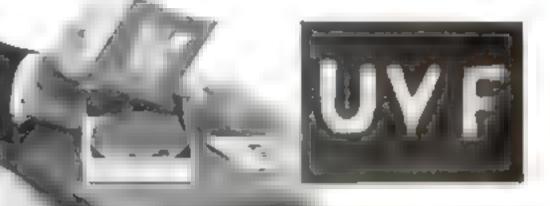
As a start in learning of the latest ray discoveries, I went to Dr. Eising's laboratory to obtain the first-hand story of his mystery rays

In a curtained-off corner of his laboratury stands a large ultra-violet lamp used for treating patients. With such a lamp, Dr. Essing explained, it is customary to use an indicator showing the strength of the rays. Such indicators usually consist of a small transparent capsule enclosing chemicals that, under ultra-violet radiation, glow with brilliant blue or green light. Sometimes the capsules break and must be replaced. Dr. Essing discovered that a test tube of ordinary petroleum



Dr Eining with the colored filters he used in an effort to identify the light that gave perrolsum is by is remarkable power. At right apparatus employed to prove radolatum says affects photographic plate Print above was made from plate exposed to rays

REMARKABLE emanations from Pertroleum jelly startle the medical world—new method found to produce ultra-violet rays inside the body to fight cancerous growth



By ALDEN P. ARMAGNAC

Cure Disease

jedy—which fluoresces with a blue glow under the myt—made a satisfactory indicator, when bung on a curtain near the camp.

It was this tube of jelly that Dr Eising took from the custain, where it had burg before the lamp for hours, to treat his difficult patient. Whatever lucky inspiration moved him to do it, he realized be had made an important discovery when the same preparation worked with signal success upon other patients. Then he began to search for the explanation of its amasing healing power

At first, he though it might be due to vitaming, formed in the petrolatum by the utra-violet rays of the lamp. He discarded this theory when he found that ordinary petrolatum, artificially impregnated with

vitamins, had no such powers.

"After fumbling around for a while," Dr. Eising says, "it occurred to me to place some of my irradiated persoleum with a photographic plate in a light-tight box." He cut a design in a cariboard stencil, placed the stencil between a photographic plate and a dish of the rayed jelly in a darkroom, and then left the combination overligh, in a box from which all light was excluded. When he removed and developed the plate, the result was startling. The plate bore a perfect image of the stencil, as plainly as if printed upon the sensitive emulsion by a powerful lamp.

Ordinary petroleum jedy not irradiated, has no such power. By exposing different batches of jelly to his lamp under variously colored glass and quartz screens, Dr Essing proved that it can be activated only by a special, restricted part of ultra-violet light known as the "cyanogen band." This

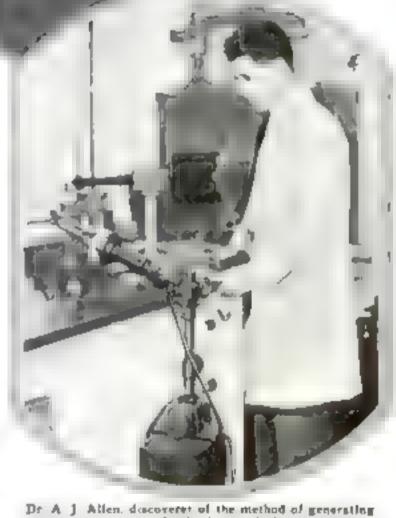
type of light is present in normal num ight, but is available in more concentrated form in artificial lamps.

Evidently exposure to this hight gave petroleum jelly the power of emitting some mysterious, invisible ray that affects a photographic plate in total darkness. New tests showed that the cutative power of the jelly and the emission of the mystery ray seem to go hand in hand. Inescapable was the inference that the ray is partly or wholly responsible for the healing result. What could be the nature of the ray?

Could it be that the jelly re-emitted ultra-violet rays for some time after exposure? If

so, the rays should behave like light rays, and pass readily through transparent pieces of quarts and film. Dr. Eising found the rays actually did pass through a protective layer of celluloid film and affect one of his plates, but in the crucial test they failed to penetrate thm plates of transparent quarta. Moreover, he found he could keep the mysterinus emanation from affecting a plate by blowing a gentle jet of air between jelly and plate, during exposure. Conversely, when he led the emanation from a flask of warmed, irradiated jelly through a glass tube to a plate, it left a dense black smudge on the developed plate. These tests suggest that the emanation may partake both of the nature of a radiation and of a vapor,

Less mysterious than the rays from radolatum, but perhaps as richly fraught

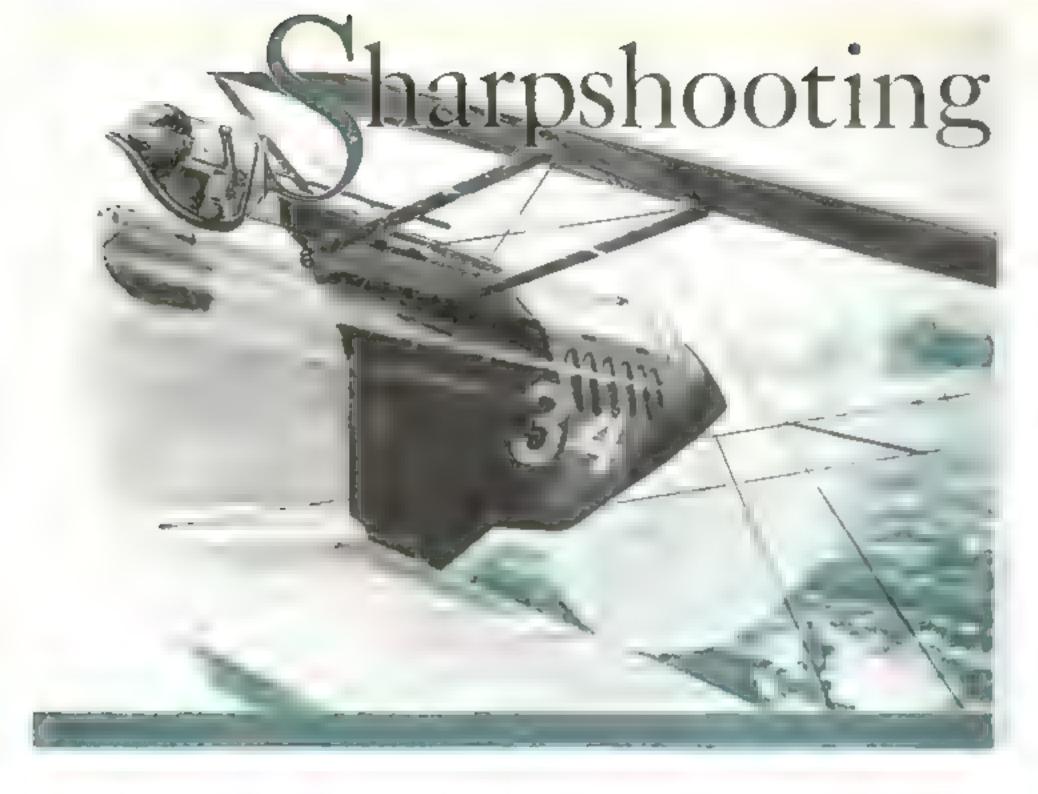


Dr A J Allen, discovered of the method of generating ultra vio et rays inside the human body in preparing the fluorescent chemicals used in his new process which is expected to be efficacious in realing concerning growth

with samificance in battling disease, is an ingenious process that makes it possible to use ultra-violet rays, ordinarily of feeble peneration, for destroying cancer ceds in deep-lying parts of the human body. Dr Edice McDonald and Dr A. J. Allen of the University of Pennsylvania, who announce the new method, expect it to prove an invaluable aid in fighting cancer,

In the new process, suitable organic chemicals are injected and find their way to the deepest recesses of the human body. Then X-rays are appued from the outside near the spot to be treated. The penetrating X-rays touch off the ultra-violet "bomh" and generate ultra-violet rays inside the patient's body.

When more research has thrown full light on the ray phenomena, medicine will have new weapons to but le disease



Uncle Sam's War Birds Pour Lead into Targets While Their Planes Fly at Hundred Mile Speed By EDWIN TEALE

tridges danging limply from one arm like a dead snake, a mechanic clambers on the lower wing of the army biplane. The war birds of the Fifth Observation Squadron are holding annual machine gun practice at the Aberdeen, Md., Proving Ground and I am to fly over this no-man s-land where government experts test big cannon to see for myself how sharpshooters of the sky are trained.

Our Douglas biplane, 34 is warming up on the starting line before immense metal hangars. Lieut Erickson Nichols, brother of the noted aviatrix Ruth Nichols, and one of the crack shots of the squadron, helps me bucke on my parachute. He is to phot me "over the lines" to the diving targets eleven males away

While the mechanic is losting our Browning gun that pokes its stubby black barrel from the motor cowling a chrome-yellow Falcon, its wheels still spinning from the takeoff, roars into a climbing turn less than thirty feet above our heads. It carries a "ffexible" gun which the ob-

reaver can fire to either side from the rear cockpit. Our Browning is a "fixed" gun, spitting 1,200 bullets a minute between the bindes of the whirling propeller A driving mechanism, attached to the cam shaft of the motor, fires the gun. The bullets, leaving the muscle at a speed of half a mile a accound, pass each propeller blade sex inches back of the trailing edge.

Last year, Capt E. E. "Tiny" Harmon, the six-foot-three, 215-pound commanding officer of the squadron, hopped off for the diving targets with a belt of old ammunition. Some of the cartridges "hung fire" for the fraction of a second. The jacketed lead struck the whirling blades and he limped home with three hullet haves in his steel propeller. That was 1920 ammunition. Ours, due to government economy, is even older, some dating from the last stages of the World War in 1918.

Incidentally, I learn just before we take out on the field for the takeoff, our chances of making a forced landing near the fixed gun range are about the same as going safely over Niagara Falls in a leaky rowboat. Huge shell-holes pit the

open spaces. All a pilot with a dead engine or a broken propeller could do would be to "settle" down between holes at the lowest possible landing speed—about fifty-five miles an hour—and trust to luck.

We are half way down the firld, wing to wing with a sister-ship, No. 35. Two planes always work on the diving targets at the same time. Lieut Joe Hollidge at the stick of the other machine, will lead our formation out; we will bead it coming back. We swing into the wind and wait for a big bomber circling the field to land

Then as a single motor, the two 600-

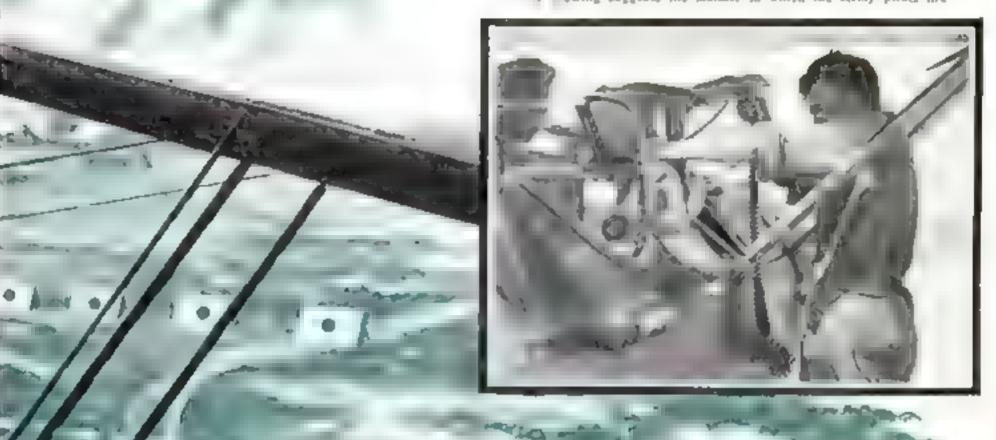


Here is the e'et ric trigger contained in a rubber handle that fits on the contro stock, which sets the Browning gun into steady action

POPULAR SCIENCE MONTHLY

from the Clouds

By w mechanic leading an Auplane's Browning gas before the are if for target practice at the Aberdeen, Md., Proving Ground, T is awing suggests the manner to which the Army priors fire





Here is your author himself, standing, right, while Lieutenant Erickson Nichols tells him what they will do and where they will go when they are making their target practice flight over Proving Grounds at Aberdeen, Md. What he saw, feit, and learned while the plane swooped down and the machine gun rattled, he tells you in this thrilling article which is packed with the hair-raising drama that goes with this spectacular form of training for air markamen



horsepower Conqueror engines how at full throttle and we are off, heading straight for the hig hangars. They foom against the sky like great gray mountains while the ships scuttle along the ground, hugging the earth. At what seems the last possible moment, we lift into the air and soar away. Yellow planes, a winding railway, and a mile-long row of cannon barrels lying side by side, like a corduroy road of metal logs, flash past below our landing wheels.

We swing in a wide circle to the left out over the slate-gray, choppy waters of Chesapeake Bay, with its root-like creeks and inlets, and come back over the proving ground at 1,000 feet. A strange row of mont hoops, through which experts fire big guns, slips to the rear beneath out wings. We head south over wasteland and marshes where clusters of isolated buildings carry red disks on their sides to warn of the danger areas in which are housed the high explosives.

The air is boiling. Our ships pitch up and down, up and down, dropping and toszing fifteen feet at a time. Gusts slap them from side to side, rock and tilt the

wings. Hollidge, with the winking owl and winking moon insignia of the squadron on his fuselage, is less than fifty feet away and a little in the lead. He ducks his head from side to side constantly on the ident. It is a dangerous day for formation dying. Nichols watches him like a hawk throtting and opening his motor, eight, in and swerving out, keeping his place and avoiding a crash by the skillful piloting acquired on a great many flights.

High overhead, three coal-slack bus wheel in the sky; the only sign of the ma perpetual no-man s-land. A decreed concrete road crawls to the far end of the periosula. Closed gates and furtering starlet flags warm that gunnery pract

is giving on and the are of he introder would be safe

Then below, we catch a flash of yellow The Falcon with the flow e gun scare axet chasing its shadow. It is heading home for more ammunition. Ahead, are four strips of white, with a wide black line running down the middle of each, laid out in an open space. They are the flexible gun targets, twenty-four feet long and six feet wide. The black center strip is the bullseye. Two targets are flat on the ground; two set up at an angle of sixty degrees. The gunner in the rear cockpit fires straight down, from 200 feet, on the flat targets, from the side, while flying along a line 400 feet away, on the ones that are set up and which look as though they could easily be hat

On both sides of us now in ets come in from the bay. We are nearing the end of the peninsula. Saltpeter Creek and the Penny-Come-Quick area lie behind



LEEVE TARGET FOR AIR GUN NERS. This imenty fout givers of cloth, with black band as bullieye, is nowed himself band as bullieye, is nowed and for a standard cable and and for standard transfer of the new right Buch target practice generally and a right buch target practice generally

Compowder Neck ahead. On the proving ground a black line runs down the mode and carries the legend. "Planes Must Not Fly East Of This Line." Across the line, big she is from heavy ordnane scream through the air during testing parties. To reduce the danger the crash-ne soom of the big set lery doesn't beganted afternoon, while the planes are in he air from six to reven an the lor the fivers, the day's work is over a eleven a military of the fivers.

We pass sed Run and above the least edge of the lower left wing appears a soft land patting into the bay the patting white rectangles, propped up at sixty-degree angles, stand in a row across the center of the field. They are the targets, ten feet high, six feet wide, with black bullseyes more than two feet in diameter. We are to take targets one and two, the pair on the left; Hollidge three and four, On our next trip, with another belt of 100 cartridges, we will work on three and four and Hollidge will switch over to one and two

Suddenly, the metallic blast of the propellers and the bellow of the motors sink to a steady drumming. With throttled engines, we slide down half a thousand feet in a wide sweep to the right and come back heading into the wind.

The observers' headquarters, at the edge of the clearing, rushes under us. A concrete wall, twenty feet high and two feet thick, protects it from ricochering bulkts. On the far side of the building as we race by, a man in brown overalls is half way up the ladder of a high observation tower. At its top, a crimson danger fing darts in and out on the gusty air like the tongue of an angry snake. Gusty days and bot days are the worst for flying gun practice. Heat-bumps and ground-gusts cuff and slap the planes so that holding the bead on the bullscye for any length of time is impossible.

Under us, a hundred feet from the building is a great white rectangle. It is T d p the glove target,

at one does the ring arong the table and trib the carch a riner. When the white sines

are up, the signal is: "All is Clear. Begin Firang!" When the black sides are up, it means: "Don't Fire!", and when the panels are alternately black and white the message is: "Cease Firing and Ga Home!" Before any of the ground crew ventures into the open, the panels are always turned black-side-up

Across the field, in front of the targets are two parallel lines. They are formed by a series of cloth rectangles laid on the ground and look, from the air, like rows of white hyphens. The first line is exactly 400 feet in front of the targets, the second 1.400 feet. The space between the two is where the firing is done. We cannot began shooting until our ship has passed the 1400-foot line, we must stop before we cross the 400-foot one. Observers, far out at the ends of the lines, watch the planes and listen to the sound of the gunto detect violations of these rules. Five percent is deducted from the score for every time a pilot keeps on firing beyond the 400-foot marker

Holbdge has swing away to give us room. We are to dive first on the targets Nichols is learning ahead. He jerks hack the charging handle of the machine gun. A live round clicks into place. On the instrument board, he dips up a little while knob marked ' bun Switch. We are div

ing on target number one, ready for action

The 1.400-foot line sweeps to the rear The ground comes rushing up; shellholes are streaking past. The black and white target expands before the nose of the plane. Then Nichols' right foretinger moves a fraction of an inch, pressing the electric irigger near the top of the control-stick Rat-a-tat-tat! Like the sound of a pneumatic hammer, the high, metallic clatter of the gun cuts through the roar of the motor Half a dozen empty cartridges pour down a chute and drop out the side of the fusclage. Acrid smoke swirls into the rear cock, or Line patts of brown shi dust spurt up behind the target. Good shot! When bullets kick up dust it is a tign they have bit the mark. For, around the targets is sod; directly behind them little open patches plowed and pulverized by

We are barely thirty feet in the air when the 400-foot line flashes by and we rocket up in a climbing turn to the right Clouds sail or our upper wings, trees burr past the lower tips as we wheel for another dive. Hollidge is going down. His plane and its shadow seem to meet, then part, as he swoops close to the ground. The sound of his gun is like the distant rattle of a stick along a picket fence. We are allowed ten (Continued on page 108)

Create Movie Characters in Clay

A Sculptor's Model
Is Used as a Guide
When Actor Is Made
Up for Unusual Role



Edmund Lowe, above, is being managed in clay by Jack Dawn as the first step in creating a makeup for the acrees. At left, Lowe made up for part. Note bulging none and acer

OVIE actors no longer struggle with makeup in an effort to get the right effect. Clay models now take the place of human beings while Jack Dawn, sculptor and makeup artist, traces in soft clay the lines of age, terrible scars, or a mustache. Three or four simple tools and deft fingers create in an hour a character that could not be completed on a human face in less than a day of constant effort

Formerly, makeup artists did all their work on the actor's face and body, building up several conceptions of the character before one acceptable to the director was found. Now Dawn, with the actor sitting before him, models his face in clay, adds the character to the model, and has it approved before he begins to tub grease

paint on the actor's face,

In making up Edmund Lowe recently to play the part of a middle-aged crook. Dawn was asked to try a bulging left nostril and a scar on the left forehead. On the tiny model, standing out in relief from a board, he pulled out the clay nose and scraped his scalpel through the head. The effect was what the director sought so then he "built up" these disfiguring marks on the actor himself and the desired character was complete

Dawn considers his most difficult task was the creation of a statue that came to life suddenly. Here, again, he worked with a model. First, he created the clay counterpart of the actor's head. From that,

and measurements of the actor's body, he completed a papier mache model. After coloring this figure to look ancient, he proceeded to make an antique of the man-

Raw umber, burnt umber, burnt sienna and red lake, properly mixed, gave him the reddish gray found in old Egyptian stone Sawdust stuck on with fish glue provided age. A second coating of glue, mixed with sand and applied in spots, gave the impression that time had worn the figure away. After the actor was stood in place on the set, fuller's earth dropped from above and blown on from the sides made him look as though he had stood there for centuries. Yet each night the actor in a few minutes removed all these things under a bot shower. Each pigment had been chemically tested to avoid impurities and possible infection.

"I model all difficult characters," Dawn explaint, "We seek effects, but never use anything likely to injure the skin. Seldom do we obtain any grotesque effects by drawing the skin. Makeup built up on the skin usually is sufficient to give the sought-

for appearance on the screen.



This status that came to I fe was made from in clay and paper mache and then the effects were transferred to the actor with vegetable dyes, glue, and furter's earth

At left, Paul Muniand the clay model from which he was made up. The tiny model was made in less than an hour by the move equipter



Wilstam H. Henderson in his Fresno, Calif., garden, with the giant six inch hibiscus he has developed

By Clarence Ebey

LANTS that grow nowhere ease on earth bloom in the gardens of Waham H. Henderson, near Fresno, Calif. With 180 new flowers, fruits, and vegetables to his credit, this young experimenter, less than thirty years old, is carrying on the work of the world famous plant wisard, Luther

Among his creations are a species of Golden Bantam sweetcom with twice as many kernel rows on every cob; a seedless Muscat grape that ripens and can be placed on the market months before other known varieties; roses that are velvet red and edged with black; fris that are tinted

ike orchids.

By crossing sugar beets with Swiss chard, he has produced a giant red-stalked chard, three or four plants of which provide the average family with greens for many months; with the aid of night-flying moths as but as humming birds, he has developed a new species of gladiolus, the flowers of which are no longer scentless but possess a beautiful perfume

In 1922, Henderson graduated from the Fresno High School. He had always been passionately fond of working with plants. so he wrote to Luther Burbank asking for employment in his Sonta Rosa experimental gardens. Out of 1,500 applicants for such work he was the one selected. His first job was pulling weeds at \$15 a week For four years, he remained with Burbank, learning of the mysteries of plant

hie from the master horticulturist. During the last two years of Buzbank's life he was his trusted assistant. In 1926, when Burbank died, Henderson returned to his step-father's ranch, near Fresno, and becan experiments of his own

One of his first accomplishments was the development of an improved annia These common flowers, so ordinary-looking they are often nicknamed "the kitchen garden flower," are usually dull in color and ungainly in appearance. By crossbreeding and selection, Henderson increased the brilliance and clearness of the colors and lowered and broadened the plants, making possible bedding that will present a mass of rambow hues. The most striking of his new annuas is tri-colored It has an outer circle of lavender an inner circle of cream, and a center of pink

A giant, ever-blooming amarylis a bly-like flower that unginated in South Africa, is one of his recent achievements, Common varieties were crossed with evergreen types to combine the ever-blooming feature with a new range of colors and petals of unusual size. Many of these massive blooms have a diameter of fourteen inches-more than two inches greater than the length of this page!

ANOTHER giant flower that grew for the first time in Henderson's garden is an improved hibiscus, or mallow, of unusual bardiness and arresting colors New varieties of Shasta datates have resulted from other experiments. Among them are some with strange, quilted petals and many with unusually large blooms. Under test and observation, at present,

Henderson has about 13,000 new iris plants. Among the newer colors he has produced in these flowers are an almost clear red, orchid shades, a sky blue, and a red and bronze combination

N ALL these experiments, thousands of plants must be grown and destroyed to obtain a handful of promising specimens. For example out of a field of 2,000 and only four were selected for fur-her use and the rest were burned, Again, of 5,000 zinnus, only ten were found fitted for further trial. The greatest skill is required in this process of selection and in the work of hybridization, or cross-breeding

In the latter task, a touch of pollen taken from the stamen, or pollen-bearing organ, of one flower is placed on the pistil or seed-bearing organ, of another The seeds resulting from this artificial fertilization are carefully planted. When the hybrid plants bloom, only the ones that approach most closely a desired combination of quanties inberited from the two parents are saved. These are again crossbred and this process continues for several years until a new type of plant, with new qualities, has been evolved

Propably the most difficult task of cross-breeding Henderson ever had was during his work with Muscat grapes. His goal was a new kind of grape, without seeds with the flavor of the Muscat and ripening in July instead of in September or October, the time when these grapes usually appear on the market.

The first step was taking pollen from the flowers of a serdless grape. This he shook off by hitting the flower clusters



RUITS and Flowers Are Shaped into New and Startling
Forms in the Gardens
of This Wonder Worker

against the edge of a saucer. The next day this fine fertilizing dust was placed on the flowers of a Muscat vine. This was a tremendous task. In each Muscat cluster are about 2,000 flowers, each only a sixteenth of an inch across. In addition, a tiny cap fits over the pistil, covering the anthers, or poilen-bearing parts of the stamen, on every flower. Therefore, it was necessary to perform a delicate operation on each minute flower, removing the cap and anthers with a small pair of tweezers before applying the polien. This was rubbed no the justile which carried it downward fertilizing the overies.

four hours a day, day after day, this nerve-straining work went on. About 500 flowers in a cluster of 2,000 were treated. When the fruit from this crossing had ripened, about 5,000 seeds were saved and planted, first in a sandbox, then in individual pots, and finally in the vineyard.

Out of these 5,000 plants, 480 were selected for further experiment. They have been growing for nearly five years and have become huge vines. Last year, Henderson opened eight or ten grapes on every vine and found one vine with all seedless fruit and many with only a few grapes having seeds. The seedless vine hears largesize fruit with Muscat flavor

About twenty-five of the 480 vines fruited last year. This year, with eighty-five percent fruiting, Henderson has found another completely seedless vine. The grapes from it are a golden color and possess the desired Muscat flavor. Since the apening time of these grapes is several weeks ahead of the usual time for Muscata, they are expected to prove of great commercial value, (Continued on page 106)

Henderson has made he Dolden Bantam corn seven inches song se tu'er shows, and has increased the number of rows, eight in old variety, to sixteen with larger kitness.





This Crameou Chard produced by Henderson, has be l'inny red stalks and red writes to its caves. The ruler shows stalk is thirteen juches in length and leaf approximately twenty-two inches long



How One Man Built



came true because the owner, Edwin G Sommer, an artist, built nearly all of it with his own hands. It is truly a bome-made house, the product of spare-time labor. In building it, Sommer demonstrated that there are many short-cuts and economies with which home-builders can save money and produce a house with a personality.

The Sommer home has thirteen rooms, and is built to last for centuries. It is of

The Sommer nome has insteen rooms, and is built to last for centuries. It is of the English Tudor style of architecture, being patterned after houses built before Columbus first crossed the Atlantic. To duplicate it by the usual methods of building would cost at least \$50,000, but it cost. Sommer only a fraction of that amount.

Construction work has been in progress for nearly four years. That may seem a long time, but it is no greater than the average home-builder spends in making plans and scraping together enough money to do the job in the usual few months. Then, considering that according to Sommer, about seventy-five percent of the work was done by himself, the time required was not great. Although as a whole completed, there are numerous little finishing touches to be applied here and there before the builder will be satisfied.

Almost immediately the savings to be made by the "build-it-yourself" method became evident. Sommer dug the cellar with pick and shovel, finding the task a telauation after bours spent at his regular work indoors.

The walls are of brick which, as every builder knows, is not a porticularly cheap material. But Sommer was after a particular effect that could not be produced by new brick-the reproduction of walls of ancient English houses. So he went collecting. From an old church be obtained used bricks that required only to be cleaned before they were ready for laying From an old office building he obtained more bricks, and from other sources still more. At one end of the bouse can be seen bricks from four different sources; but they blend together so perfectly that the casual observer never would know it,

The walls grew under the hands of the owner, helped by laborers called in to do the beaviest work. Also be found it advisable to hire specialists to do the wiring and plumbing and other forms of work requiring special knowledge.

Material for the framework came from old buildings. Huge, hand-hewn



Close-up of studio window which webout its leaded glass, weight three toos and is the bome a most unusual feature

a \$50,000 HOME ·

How One Dream
Shows How To Use
Get What You Want
By



beams went into the structure-beams so

scasoned with age that it was almost im-

general form of the house became evident

At one end was a huge room, measuring

twenty-two by thirty-seven feet, which

was to become a studio. Next to the studio

is a dining ball, a long, rambsing room. The entrance vestibule opens into this

When the walls neared completion, the

possible to drive nails into them



r a is do the study, break i hook and kitchen

The studio room is the most appearance in the house. The sharply pointed roof is typical by port the roof fourteen high results and the state of the

place with block and tackle Accentuating the size in the enormous studio window, copied from one in a building at Warwicksbire, England. The window, without the leaded glass, weighs three tons. It was built by a group of German craftsmen at Cleveland and is one of the few units of the bouse that were not made on the site. At one end of the studio is a freplace, of giant proportions like its surroundings. A full-grown person can

stand reside it, with a foot or two to spare

Istoric of the house are of heavy oak the process in the place. The final firms well be was. Wood work other than the fir beams to of oak and chestnut. Sommer searched the countryside for most chest out trees and finally found three not for rom Brandywine. He bought the trees and had them out into wide boards and plit into shingles. He was surprised at he amount of lamber that he into near there was enough to make all of the ham spot shingles, which required a year of his time to lay, and enough to panel the walls of the mids and breakfast room, for linest over windows, and for other uses.

The chestout-covered walls are typical of the method followed by the buttder in order to obtain the effect he wanted. The boards are held together at the edges by butterfly wedges. The surface of the lumber was left uneven and given a wax housh after it was in place.

In the homes of Old England, walls are covered with a white plaster which, as the years pass, takes on a rich coloring from smoke and grease furnes pouring out of the huge fireplaces. Sommer does not want to wait years in order to obtain this effect so, as soon as finishing touches are applied to the wall surfaces, he will build particularly smoky and greasy fires in the tireplace and in smudge pots, and let the furnes color the walls.

Being an artist and interior decorator. Sommer naturally has incorporated more detailed work into his home than the average builder would attempt. He is an expert wood-curver, wrought-fron craftsman, and cabinet maker. Close approach to the outside of the house at once reveals this. Here and there in the walls, particularly over the entrance doorway, are act little plaques. (Continued on page 107)

WHY BUILD YOUR OWN HOME?

WHEN you build it yourself, you know exactly what kind of a house you have both in material and workmanship. Knowing every part of it intimately, your home has a personality and a character that no money can buy. This article tells you how one man built the home of which he had dreamed for sixteen years. You, also, can get what you want and save nearly seventy percent of the cost of a home built by a contractor. You have the fun of building for yourself and, in addition, you make excellent wages. It is merely a question of application, skill, and time.

Microphones Run This Office





Los Angeles. Carf. have extract stenographers' to serve them by means of a foud speaker system recently instanced. These gir while seated in a cen fal office, greet calters in any office, answer tenants telephone talls, write festers, keep moks. 6c over messages, and keep unters red visitors out

our electrical chanters make the system pass hie. Three of them are to nected with the baseing a current. The four lessing from once microphones to stenogra, hers, derives its power from are on a risk and basteries in series.

Fish tenant has a complete office organization on his desk—in the form of six push but ons a second that are self-second, be pushes the button marked, "office assistant." This flashes a light on the control board in central office, whereupon the tenant speaks whatever instructions he de-

A TO THE TOTAL OF THE PARTY OF

other buttons, l:

person. The devices do everything but think. If a tenant leaves without "checking out," the act of walking through the doors registers him "out" on the control board

in central office. If a visitor tires of waiting, he pushes a button beneath the microphone, and leaves a message. All transactions with the employees are private.

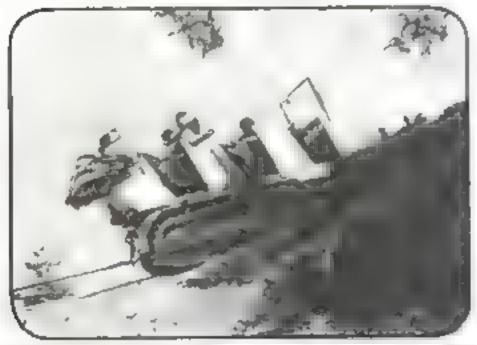
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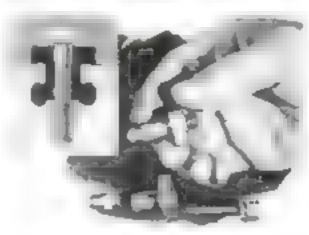
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HOTEL'S TANK CARRIES SIGHTSEERS UP MOUNTAIN



Sighterers in Bavaria climb a mountain in a tank car with tractor fread

RIDING up the side of a mountain an a tank is a new extremence afforded lour sts visiting at Oberach. Bayaria One of the progressive hotels there has installed a thirty-four horsepower tractor tread tank for the use of its guests. In it they are taken to the top of Wall Mountain, making the ascent in about an hour The tank has proved popular and others may soon be in use

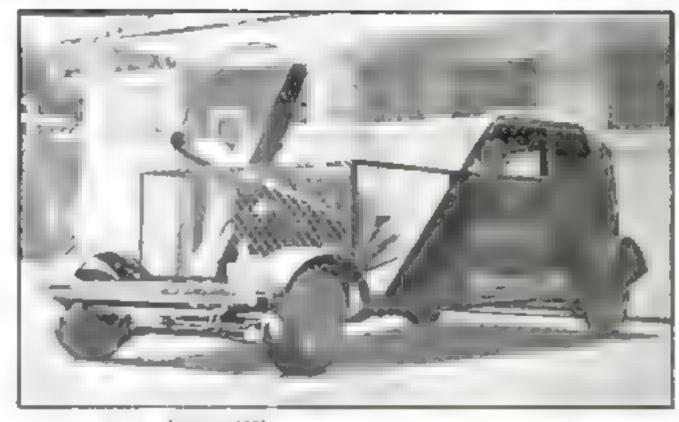


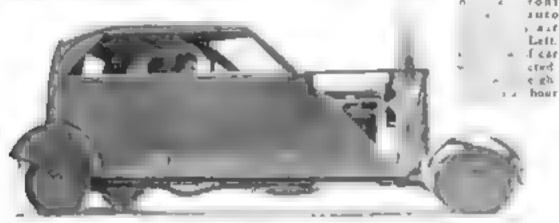
SOFT PLUG SEALS LEAK

Leaks in tanks can be plugged permanently without removing the contents, according to the manufacturer of a new plug Composed of soft metal, it has a steel bolt ending in a hard nut. The plug is inserted at the point of the leak. Then the bolt is turned down, compressing the soft metal.

Air Driven Auto Goes Eighty Miles an Hour

CLIMBING steep hills covered with shapery ice is only one of the feats claimed possible for a curious airdriven automobile recently tested at Detroit, Mich. A four-bladed propeller, driven by a 100-horsepower engine, pulls it along like a tractor airplane. With a wheelbase of 132 inches and a weight of approximately 1 500 pounds, the strange machine is said to reach eighty miles an hour and pover thirty miles on a gallon of fuel Because the wheels roll free and do not drive the car, it is not necessary for them to grip the ground as on a conventional machine. Consequen ly, the air-driven auto can travel a ung muddy roads or camb shopers hals without dillicular To hold the machine on the road when it is going at high speeds, the front of the body top a slanted so the property s t as s rikes I at an angle, pressing downward. Wire guards surround the





whiching propeller blades to prevent accidents. According to tests, the inventor reports, the five-foot propeller gives four times as much forward drive to the machine as could be obtained by conventional rear-drive wheels, enabling the car to carry from six to eight people easily. A new 800-pound, three-passenger model is new under construction in which will be incorporated many refinements in the design It is expected to cover forty miles on a single gallon of gasobne and will be able to attain a top speed of almost two miles a minute without running the danger of leaving the road or overturning.

USE COFFEE AS FUEL IN BRAZIL LOCOMOTIVES

Correx beans are now being pressed into compact briquettes and used for fuel in locomotives and factories in Brazil. Due to conditions in Brazil, which produces most of the world's coffee, these has been an enormous oversupply of the beans this year. Hundreds of thousands of sacks were dumped into the sea before the klea of using the coffee as fuel was suggested. The dried bricks are said to produce ample heat for the boilers.



NEW WRITING KIT MAKES RAISED GOLD LETTERS

liv Means of a new tok and powder you can turn your ordinary writing into embossed letters of goad or silver. The writing can be done on paper or any other non-absorbens numeral. Over the freshly-written words, the powder is poused and the surplus removed by tapping the back of the sheet. Then the paper is held over a gas flame, electric hot plate, or alcohol lamp to fuse the ink and powder together.

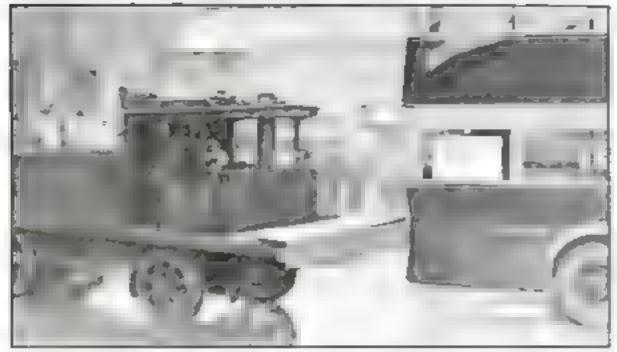
Coffee pressed into bracks to be used as fuel in locomotives in Brazil

AIR GUN FOR CAR FOILS BANDITS

LATEST defense against motor bandits in England is a cornpressed air pistol carried on the steering column of the car within instant reach of the motorist. The weapon, which shoots bullets and makes a loud report, is manufactured by a Birmingham gunsmith, Because it is operated by compressed air and not by explosaves, it is said motorists can carry the arm without the necessity of taking out a firearms permut, ordinarily required by law



England's Metal Bus Tested in Thrilling Crash with Truck



A THRILLING crash test, in which a four-ton steam lorry smashed bead-on into the rear of a double-decked hus, was recently staged at Birmingham, England, to demonstrate the sturdiness of the all-metal construction of the bus. The only damage done the bus was a broken pane in a rear window and a dent in the body. The manufacturers of the new steel-and-metal coaches are emphasizing their safety features, putting on tests to prove they would minimize the number of fatal ties resulting from but collutions if adopted throughout England. The bus used in the demonstration crash was a double decker, similar to those now in service on London streets. The new bus is intended, primarily, for use in city traffic where the majority of accidents now occur, but its designers say it would prove highly practicable for use on the country highways in interurban traffic



LIVE TREE IS MAST FOR DERRICK ON BIG JOB

A min pine tree, four feet in diameter, was turned into a derrick-mast by a western construction company without cutting down the tree or guying the top, the root anchorage proving strong enough to hold the tree in place in spate of the loads handled during the operations. The boun was fastened around the trunk about twenty-five feet above the ground, and the outer and attached to a cable that passed over a sheave in the upper part of the tree. The tree was used during the construction of a rock fill dam.

GRAND OPERA WEAPONS MADE OF SCRAP IRON

GLITTERING battle axes carried by grand opera knights are now being made from scrap from taken from the dump-heaps of steel mills. One western from is specializing in producing ornate halberds and other medieval weapons from such pieces of discarded metal. Secaule papier-mache pikes and axea fail to clang realistically when clashed together in battle or when falling to the floor, metal weapons are favored for theatrical work. Further realism is added by giving the weapon a finish characteristic of those used centuries ago



COMBINED CHAIR AND EASEL FOLD FLAT

For the convenience of landscape painters and etchers, a New York artist has invented a combined folding chair and easel. It folds into a compact object which can be carried under one arm, thus reducing to a minimum the amount of higgage re-

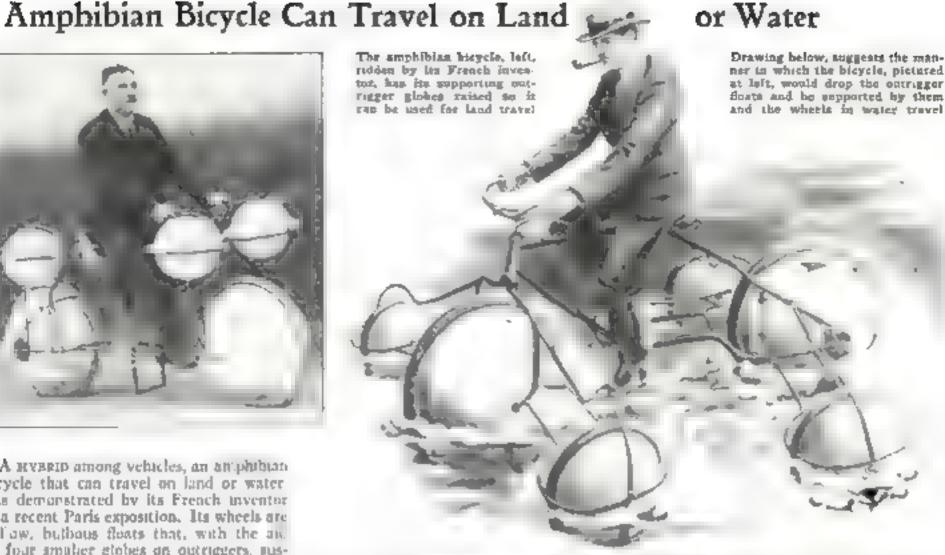
quired for a sketching trip. The combination that and casel is anoptal a for practically all sorts of artistic work, and can be used in the studio for portrait work as well as in the field for landscape painting. The easel is set at a convenient distance from the seat for sketching or painting



As right a rewel cases and chahaving the logether to find the hier shows above, so they are say y carried when the artis leaves studio for outdoor work



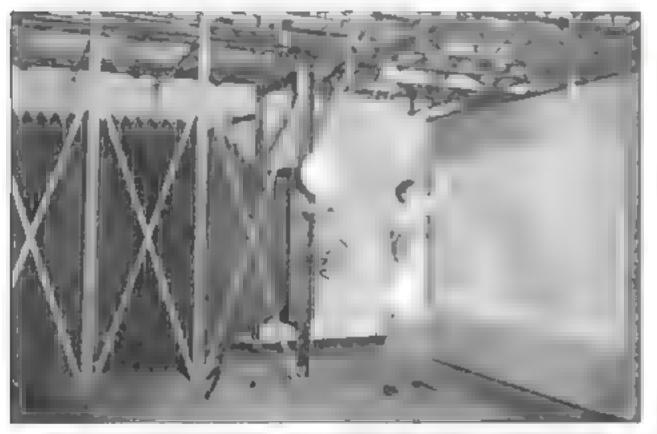
A HYBRID among vehicles, an amphibian h cycle that can travel on land or water was demonstrated by its French inventor nt a recent Paris exposition. Its wheels are hollow, butbous floats that, with the air. of four amaker globes on outriggers, sustoin it in the water. All of the floats revolve freely like wheels, resulting in a mornium of drag. When the rider pedals across the water, fins on the rear wheel



serve as paddles to drive the machine forward. For a ride on its land the outnegers supporting the outer floats may be folded up clear of the ground, Proof that

the floats would be sufficiently buoyant to support the rider was given when the inventor navigated his device, without diffe culty, account a large swimming pool.

UNCLE SAM GETS GIGANTIC CAMERA



Columnal camera, with eight-foot bellows and holder that will take a four-by-foot foot plate to suspended in air and used by U.S. Geological Survey to take accurate photos

510 enough for an eight-year-old child to walk through, a camera that can use any plate from four by five inches to four by four feet, has been designed for the U. S. Geological Survey. It is suspended from an overhead track twenty-five feet long and four feet wide. This suspension prevents vibrations from the ground or building interfering with the apporatus. The great size provides for copying with the greatest precision and accuracy Of the total weight of practically three

tons, the bellows alone weigh 450 pounds

Its length, closed, is thurty inches, fully extended, it is eight and one-half feet. Even this is not enough for some of the work the camera is required to do, and additional length is provided by a thirty-aix inch cone. The camera can enlarge eight een diameters, or reduce a ninety-six inch drawing to two and one-half inches. The copy holder, weighing 1,000 pounds, moves on the track in either direction, and both it and the camera are mounted on roller bearings. Wet plates, dry plates, or paper may be used in the cameras.



MIRROR PART OF COMB

A POCKET comb that carries a mirror at one end is the bandy toilet accessory produced by a Partland, Ore., inventor, The round glass is permanently set in the hard rubber of the comb. The (wo-m-one comb is five and a half inches long, slapping easily into pocket or bandbag

AUTO STOVE HEATED BY CHEMICAL REACTION

LITTLE larger than an open hand, is a fireless stove designed by an Italian inventor for heating automobiles. With a warming power of 200 calories an hour, it will run for thirty hours on one filling of gasoline. The fuel is not burned in the stove, which gives off no flame or sparks Chemical reaction, induced by a cuta year apparatus within, produces the heat.



Chemical reaction beaver for use in autom

What You Can Do with



in world so tided with teer me lit bale curn yorn and a datic "monsters. the the ribidest parch of South American parale of the darkest hours te become by comparison mergrounds occupied by some of parties a

No dream was evily in 10 forcborn g, were der of as those that eye by a 1 ing down in carrier of wa n pond of state Life! Nowhere is the struggle to live more intense, more dramatic, treacherous,

Touring the sub-world with an inexpensive eye-piece is the most exciting pleasure that one can contemplate. We enter a

cream would of life death, destructions.

g ory, design, chaos, and tranquility In this series of articles we speak not of the highly specialized habits of atrical aria videaris of the biological secrets of serpula vermicularis. Leave those studies to the technicians. We're mere tourists' It mat ers att e whether we know the roads ,but we travel or the names of the towns that we pass through so long as we get a good view of the scenery! Animalculaeville or Crystaltown are but places to stop and treat our eyes. We don't have to be geologists to revel in the Grand Canyon

views from a microscopic world.

How much will the trip cost and how much baggage shall we have to cars along? We travel by the aid of a small coinpound microscope of the students' variety capable of magnifying a hundred diam eters. By a compound microscope, we mean a microscope on which there is an (1) objective and (2) an eye-piece or occular which in turn amptities the image already amounted by the objective. If the object tive magnifies fifteen dameters (times) and the eve-piece or occular five diameters then the total magnification of the microscope will be seventy-five diameters

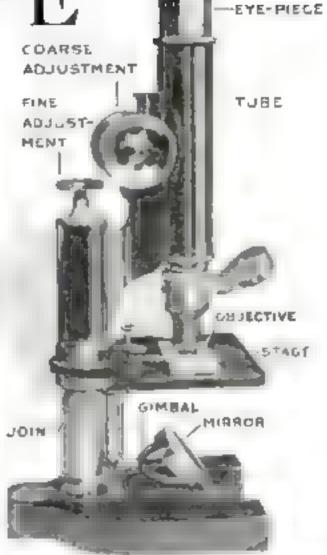
Cost? What would you pay for a trip to a land you had never seen in which were wonders by the score? The good news is that you do not have to be rich. Manufacturers of optical apparatus have taken

care of the requirements of amateur tourists into this world of the unbelievably small and offer excellent small microscopes at prices that are easily within the means of all. In buying avoid mistake number one by NOT buying an instrument with higher power than that mentioned, that is not much higher. If you do, you will find he technique of operating it far beyond your training and you will become discouraged at the tollgate of a country far beyond your wildest dreams. Avoid pustake number two by carefully examining the glass of the instrument you buy, It must NOT be scratched

Microscopes of the power mentioned may be purchased anywhere from twenty five dollars up depending upon the number of refinements and accessories. Twentya Microscope



Above is a magnified view of the was a neter on a bien a leg. At well a cooter co strated of the World Wear enforced twenty times.



Here is the contrament you will want to not with each pair labelled. Its good to \$25 and apward

Here's a Hobby You Can Ride to Wonderland

a Worth theng two

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for fine focusing

In THIS series of articles on the use of a microscope, a new and fascinating subject is brought to you. The articles will be written by an amateur microscopist, and exactly those things that one unfamiliar with the use of a microscope will want to know, will be told in a plain and simple way. Endiess hours of real delight await you if you begin now to get ready for the entrancing excursions into an unknown world upon which this series will conduct you.

five dollars should be all that is necessary for we shall make most of our baggage as the tour goes on.

Those who have not operated a compound interoscope have no lites of the world in which they find themselves, for we must keep well in mind the fact that we not only magnify motion but speed and distance as well. For instance, the magnified area of a fair powered instrument may be as small as ten one-thousandths of an inch and this is large compared to the really high powered eye-pieces. Little wonder that we shall have to have (or develop) deft fingers. However, this is not a great chore where the lower powered machines are used.

Illumination is important, too. Properly

to see things, we must arrange an artificial source of light so that it strikes the little mirror under the stage of the microscope and w reflected upward through the leas. This light must be nicely adjusted to suit your eves, and will be found interest for different people. It should not he too bright or if will cause fatigue and headache. Then it should be even so that the whole field of the lens will be uniformly illuminated. Indeed much of the success of your tour in Tiny-land

will depend upon how cleverly, how patiently you arrange your illumination. A attle practice will permit you to make the necessary adjustments quickly. It is a fault of the beginner to use too much light rather than too little

Some amateur microscopists use daylight but the disadvantages are rather
numerous. First, direct sunlight should not
be used because of power and probable
damage to the machine. A north light is
difficult to control and is variable. The
best arrangement is that of a low wattage electric light of the frosted white
variety arranged in a tin can as illustrated.
This is mounted in this way for the microscopists will find it best to work in a
darkened room even with a low-powered

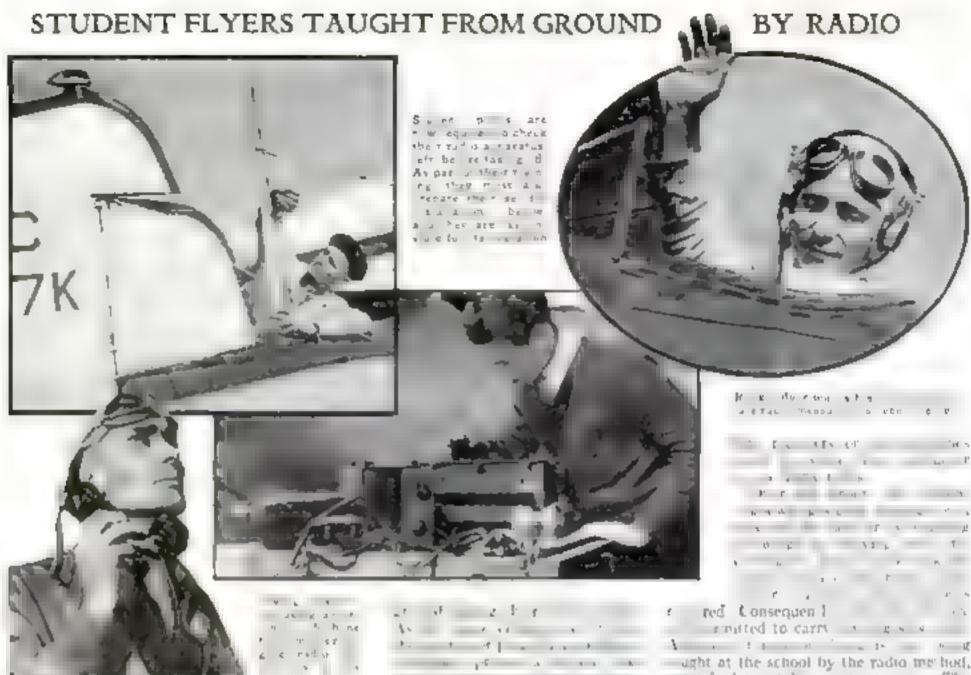
instrument. Such a mounting preventageneral diffusion of the Light.

The distance the light is placed from the interoscope and the degree of illumination will to some extent, depend upon the individual and his sight. Of course, the experienced microscopist looks into an eye-piece with both eyes open while the beginner either squints one eye or closes it totally. While it might be rather awkward at first to use both eyes, it is really best as it minimizes fatigue and we gradually become so absorbed in the wonder revealed to us that we see nothing with the other eye even though it is open

Now for some of the buggage we are going to make for ourselves. It is fun and it saves money This business really calls for a small butcher shop, at least for biological specimens. The dissecting kit should be made up of a scalpel, a tiny pair of scissors (cuticle scissors used in manifuring will do), a pair of forceps, four needles set in handles, and a tiny camel's hair brush.

The scalpel comes first. It is the butchering knife and it must be sharp, so sharp that what it cuts will be cut and not torn. This little job is nearly made up from an old razor blade. If one of the single edged narrow blades cannot be had a double edged one may be clamped firmly in a vise and broken off. It will break clean and then may be mounted in a handle whittled from some fairly hard wood. The end of the wooden handle is split and the blade inserted, being bound in place with oiled thread of heavy size.

Large needles, to be used in picking up specimens, are (Continued on page 92,



ROOKE phots, circling the Oakland Case, airport on their first solos, now hear the comforting voice of an instructor giving advice or encouragement by radio from the ground below, Student planes at the Boeing School of Aeronautics there are equipped with small receiving sets so student pilots can be coached from the

munication with the plane

Each time giving the number of the plane, to let the pilot know he is being addressed, he points out mustakes and aids the beginner in keeping out of trouble while flying and landing. Besides, he is able to warn of wind changes, bad visibility, and approaching storms when students are on short practice cross-country hops.

aght at the school by the radio me hod, weral planes taking part at once. The amateurs fly turnt formations, kick their ships into tauspins, and fly figure eights in response to radio commands. Instead of waiting until the students land to discuss mistakes, the instructor can point ou errors as they occur and have the rookies go back over maneuvers until they get them eight. Before every solo flight, the students must check the radio equipment



CAMERA NOW CARRIES ITS OWN FLASHLIGHT

News photographers now use a high-speed camera that provides its own flashlight. A socket built into the side of the camera, holds a flashlight bulb and batteries are concealed within the box of the instrument. As the shatter is snapped, electrical contact is made and the flashlight goes off.

BARREL POOL ON LONDON ROOF

Constaucted like an immense rubber barrel, an odd collapsible swimming pool on the roof of a botel provides out-ofdoor bathing in the heart of London, England, The bathers enter the water from two platforms at opposite sides of the barrel pool, which is eight een feet across and has a depth of about five feet, Heavy cables, which encircle the rubber container, are attached to uprights that serve as staves and thus hold the barrel in position. The unique pool, it is said can be set up or taken down in a short space of time. It has proved popular and other and larger barrel pools are now being constructed,



Shaped like a barrel, this rubber bathing pool is in use on a London roof

Stretching Scales Test Road Rock



Chemista take the rock dust and break. It down with suitable a or nitric acril so as in determine to exact chemical composition.

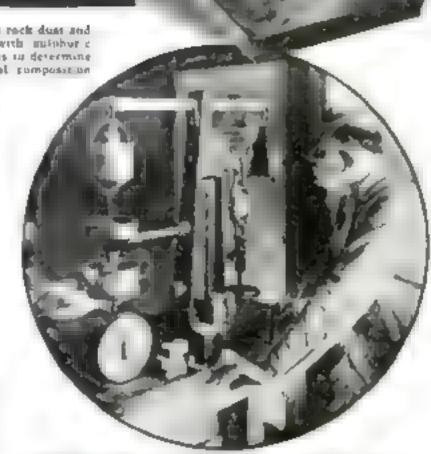
Wirit "rock stretching" scales, with acids, and with electric granders fitted with diamond edges, a staff of experis at the Los Angeles Testing Laboratory, in Calfornia, put samples of stone, to be used in street foundations, through searching tests. First, rock chemists grand samples to powder and then "break them down" by the use of sulpharic or nitric acid, into their chemical constituents. In this way they determine the composition of the rock and its sustability for various types of construction work.

The second step is combining some of the powdered stone with sand and cement and placing it in "figure eight"-shaped pends to dry. As a test of tensile strength these forms, when thoroughly dry are placed in the stretching machine." Two Usuaped Jaws on the apparatus clamp over apposite ends of the figure-eight forms and pull in opposite directions. A meter on the device records the exact pull

required to make the formpart in the middle. As the proportions of sand and dement are identical in all he forms daterences in tensile streng b which the apparatus reveas are due on irely to differences in streng b in he is me itself.

In this way the testing engineers are able to determine the tensile streng h of a particular chemical combination and to pick material best suited for foundation work on streets and highways.

From every truckload of stone delivered on a city job in Los Angeles, a sample must go to the testing laboratory for analysis before the rock can be used.



Powdered rock goes into the forms

seen below and is there mixed with

sand and cement and dried into blocks.

before it is persod on in stretching

machine for test of its tens le property

This machine pulls the took is two directions while the districted the amount of stress exerted before the rock splits

Wrecking Truck Carries Its Own Battery of Big Floodlights



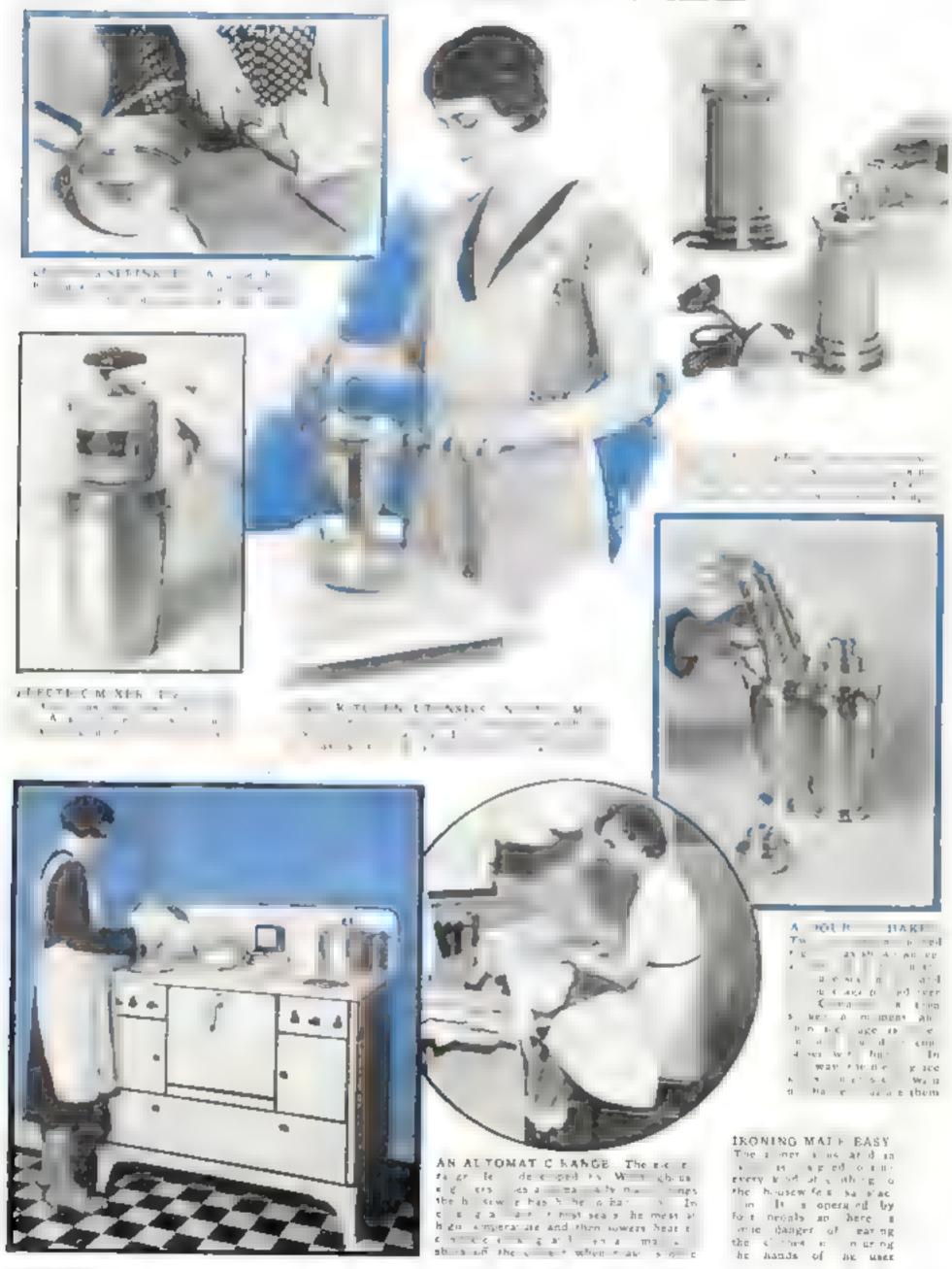
Equipped with a battery of floodlights, this wrecking track provides "daylight" at the scene of an accident

SUPPLYING current to a string of powerful floodaghts, a new wrecking truck, recently tested at Buffalo, N. Y., speeds up work at the scene of an after-dark auto wreck The backery of aights can be arranged in any desired position and can be switched on within a few numutes after the arrival of the truck. They fileminate considerable area. providing light-an-day working conditions for the crew. The car's regular batteries, which furmuch the current, are powerful enough to run the habis for some time

Helpful NEW TOOLS AO APIT'S IN TABLE the table is table to an or a The take of the are a bu e e a u a c ae ow his weeken of a sea of a

POPULAR SCIENCE MONTHLY

for the HOUSEHOLD



EXPERIMENTS IN

Electrohemistry

by Raymond B. Winks

hatteries, a magnetic compass, and a few other odds and ends to his home laboratory equipment, the amateur chemist can perform many interesting experiments in electrochemistry—that branch of chemistry dealing with electricity

Like heat, electricity plays an important part in many chemical reactions and countless industries make use of electrochemical processes. Not only does electricity bring about chemical changes but many reactions produce electricity

Visible chemical reactions, however are not the only means of producing an electric current. A tump of sugar broken in two produces a faint blue spark that is visible in a darkened room. Similarly rubber, celluloid, or amber rubbed with cloth or fur becomes electrically charged and will attract certain substances. This is mechanically produced electricity

An electric current can also be produced by heat. This can be demonstrated best by twisting a copper wire and an arm wire together for a distance of about one inch. When the junction of the two wires is heated, a current measuring device connected to the free ends of the

wires will indicate the presence of an electric current

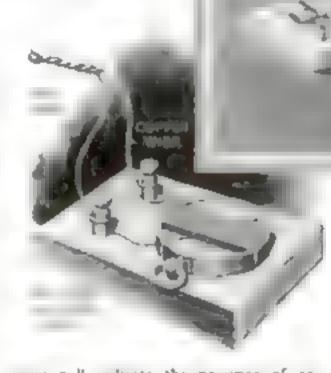
Current produced in this manner is said to be thermoelectric and the junction of the two wires is known as a ther mocouple. Because the amount of current produced is proportional to the amount of heat, thermocouples are used in taboratories for measuring temperature

To experiment with the thermocouple, it will be necessary to obtain some sort of sensitive current indicating device. A

v turn of mean rd who around the case of a small magnetic compass in the manner indicated in the drawing above in use the unconnected wire coil is first for as until it is directly over and parallel to the magnetic needle. Any current mining through the wire will cause the credle to swing away from the coil to a point at right angles to its original position. For convenience, the coil and compass can be mounted on a suitable wood base and two binding posts can be supplied for the connections.

The fact that electricity can also be produced by chemical means forms the basis of the electric battery. A simple battery can be made by placing strips of copper and sinc in a dilute acid solution such as lemon juice or vinegar or in a simple salt or sal-ammoniac solution. The current produced by this battery can be detected with the gal-ammoniater. A really practical battery of this type can be made by immersing a carbon rod and a sinc sheet in a solution of sal-ammoniat.

Batteries producing electricity by the cuon of a single solution on two electrodes of different metals is called a displacement cell or battery. Another type, consisting of two electrodes of the same metal placed in two solutions of different strength, is known as a concentration cell.







Mysteries of Electrical Action Are Revealed with

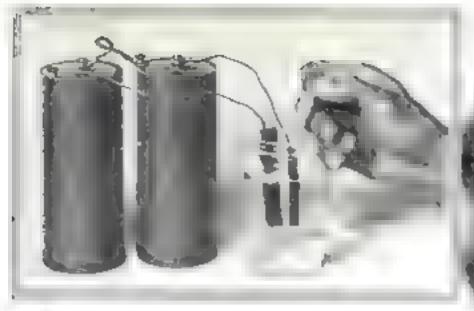


Fig. 3. This is an experiment in electrolysis. An electric current is passed through a said omich or de sourt on any gas is produced which can be identified with itmus paper as throme

A simple experimental battery of the concentration cell type can be assembled from a glass tube, a stopper, some copper wire, and two solutions of copper chloride of varying strength. Fit the stopper in one end of the glass tube and insert a copper wire through the stopper so that it projects an inch or more into the tube. Set the apparatus upright and pour in a strong solution of copper chloring, half filling the tube.

Mix a weaker copper chloride solution and careful y pour thin into the tube so that it floats on top of the stronger and heavier solution. Insert a copper wife in the weaker solution and connect the free ends of both wire electrodes to the galvanometer. If the solutions have been carefully placed, the galvanometer will show the presence of electric current.

A sheet of biotting paper, moistened with vinegar and placed between a twenty-five cent piece and a penny, will also form a novel battery demonstrating the action of chemicals to produce electricity. The coins form the electrodes and when these are connected to a galvanometer a small current will be detected.

A model tell of the storage battery type can be made easily from acraps of read foil and a small quantity of dilute sulphuric acid. Mount a sheet of lead fuil, such as it used for wrapping tobacco or tea, on each side of a thin piece of wood, which is larger in area than the sheets of foil, and hold them in place with rubber bands. This unit is then immersed in a weak sulphuric acid solution made by mixing one part of the thick, strong acid solution with ten parts of water. Stir the solution with a glass rod and allow it to cook.

Your storage cell is now ready for charging. To do this connect a wire to each lead plate and run these wires to some suitable source of direct current Dry batteries can be used, but better results will be obtained if a battery charger, such as is used for radio work forms the current source.

As the current flows into the battery cell, bubbles will form at both plates, indicating the formation of a gas at each electrode. The gas at the negatively charged plate is hydrogen and that at the positively charged plate is oxygen

Fig. 4 How two alive bottles, tubbet stoppars, glass tubes, and rubber tubing can be assembled to form a substitute for a U-tube

As the charging progresses, a chocolate brown deposit will form on the positive plate. Allow the battery to charge for several minutes more and then disconnect it from the current source. The battery is then charged and will light a small flashlight connected across the lead plates.

Contrary to the idea suggested by the name, a storage battery does not store electricity but chemical energy, which may be converted into electrical energy at will.

If desired, the acid used in this model battery can be poured off and used for other purposes in your laboratory.

The Edison storage battery consists of special iron and nickel electrodes immersed in a solution of some alkali such as potassium hydroxide. The home experimenter can duplicate this cell by suspending a strip of from and a five-cent piece, which is composed mostly of nickel, in a lye solution. Copper wires soldered to the from and the coin will serve as terminals for the cell.

Fig. 4. The trees, resembling the figure at left, are grown in a to bulk or two by means of the apparatus if astrated below. The secret of the experiment is the electrolysis of at dulated tip chloride so ution.

Electrolysis, the process of breaking down a compound by passing an electric current through it, forms an interesting study for the amateur. A simple solution of salt in water, for instance, can be broken down by electricity and hydrogen and chloring gases produced.

An ordinary mayonnaise for forms an excellent container for electrolysis experiments in the home laboratory. Make a sodium chloride solution by dissolving ordinary salt in water, pour it into the jar, and insert two electrodes—into, a carbon rod, and the other, a strip of copper. These electrodes are in turn connected to the terminals of two dry batteries arranged in series—the copper strip being connected to the negative terminal and the carbon to the positive.

When the current flows, a steady bubbling at each electrode will be noticed indicating the formation of gas. The gas coming from the carbon rod will have a pungent odor characteristic of chlorine gas. The identity of the gas can be definately determined by the fact that it is a powerful bleaching agent. Littous paper or coursed cloths wetted and placed near the carbon electrode will soon lose every trace of color. Once recognized, however, the odor alone will be sufficient to allow you to identify this gas. The gas hubbling from the copper strip, which is connected to the negative terminal of the batteries, is hydrogen,

Salt, or sodium chloride as the chemist calls it, is composed of sodium and chlorine. It is the commonest of that group of chemicals classified as salts. In our experiments with solutions (P. S. M., Oct. '32, p. 55) we found that when an acid a salt, or an alkali is dissolved in water, it will (Continued on page 87)

Simple Apparatus in Your Home Laboratory

Grand Prize Winners HEROES OF SCIENCE Picture Cutting Contest

INNERS of the Grand Prizes in our Heroes of Science picture culting contest are announced here. The winners in this contest saved the extra parts from each contest from May to August inclusive and sent in their entries after the appearance of the August issue. An almost unbelievable number availed themselves of this opportunity

and the judges were forced to work with the utmost chigence to determine the winners in time for publication in this issue. Great ingenuity accuracy of information, and artistic skill were displayed by the successful contestants. Hundreds of those who failed to win a prize deserve favorable mention for the high standard of their efforts.

FIRST PRIZE \$2,000

Phil Sapossnek, Brooklyn N. Y.

SECOND PRIZE \$500

Paul Kovacuk, Akron, Ohio

THREE \$100 PRIZES

George Carnevale, S. Ozone Pork, N. Y. George Martin, Camden, N. J. Ferdmand Sabatan, Brooklyn, N. Y.

FIVE \$50 PRIZES

James K. Huffman, Hempstead, N. Y. Irving Krum, Philadelphia, Pa Elwin Leslie, Lakewood, Ohio C. W. Morgan, Chicago, Id. Charles North, Glenbrook, Conn.

THIRD PRIZE \$200

Paul Boniface, Morrntogen, X. J.

TEN \$25 PRIZES

John A. Amato, Bronz, New York Samuel M. Barnes, Philadelphia, Pa G. Carlson, Los Angeles, Calif Viola Cromby, Memphis, Tenn David Felzer, Bankegan, Ill Charles Gray, Brooklyn, N. Y Raymond Guerry, New York City Charles Lind, Hickstelle L. L. N. Y Hans Passburg Longmeadow, Mass R. B. Sandford, New York City

FIFTY \$10 PRIZES

J. H. Anderson, Lathrobe, Pa. Margaret B. Andrews, Horcester, Mass Elmer Benson, Molme, Ill. William Blake, Mimeie, Ind. G. S. Blomme, Il ilmington, N. C. Walter Blume, Washington, D. C. James H. Hoyle, Hamden, Conn. Frank Canme, New York City Letha Cieland, Van II ert, Ohlo E. Cowperthwait, Philadelphia, Pa. F. J. Craig, Andover, Mass. V. Deckert, New York City W. F. Druzik, Pittsburgh, Pa. L. E. Engle, South Bend, Ind. R. B. Fasts, Lorain, Ohio A. Fieldbrave, Christopher, Ill. L. W Fuller, Kansar Cuy, Mo. C. E. Garlick, Portland, Ore. G. M. Glassco, Fl arren, Ohio J. C. Glore, Atlanta, Ga. Weaver Harris, Nashville, Tenn. Marye C. Hicks, Chicago, Ill. Betty Howard, Lincoln, Nebr. G E. Hoyl, Stotes City, Iowa Rose Juhus, Erre, Pa.

Arthur Kalmbach, Grand Rapids, Mich. R. La Fourcase Cleveland, Ohio L. J. Lambiase, Brooklyn, N. Y. C. B. McCollister, II ilmington, Ohio P. H. Milier Greely Colo. W. L. Neuenschwanger Akron, Ohio. Margaret Parke, Georgetown, D. C. R. H. Pool, Larned, Kans. P. L. Potin, New Orleans, La. Tasma S. Reddy, Montelow, N. J. E. S. Rinehart, Mersersburg, Pa-Mary L. Rowlette, Muncie, Ind. Paul Schmidt, El Pasa, Tex Margaret P Schedler, Fall Creek, E. K. Shelton, Pittsfield, Mass. W. R. Stott, Memphis, Tenn O. C. Swaren, Chicago, Ill. Louis A. Tinari, New York City G. Van Alst, Huron, S. Dak E. F. Wadley, Jackson, Tenn. A. P. Warner, New Hoven, Conn. O. J. Weaver, Cleveland, Olno G. T Welch, Providence, R. I. Stephen Wieland, Lytton, Iowa W. T. Wyckoff, Belle Fourche, S. Dak.



OF OLD AUTO PARTS

JUNE yard auto parts provided the material for an ingenious hoist which a Los Angeles, Cauf., contractor rigged on a light truck to lift roofing materials during building operations. An old auto wheel with a wide rim forms the drum. A chain and sprocket, operating through an old transmission, applies power from the truck cogine. The transmission gives three choices of houst speed with one engine speed. The outfit was built for a small sum, is light, and yet will handle heavy loads. Placed at the front, it is out of the way when the truck is used for hading.



NEW SHIELD PROTECTS MOTORIST FROM GLARE

AN ADJUSTABLE glare shield mounted on a swinging arm has been designed to protect motorists from late afternoon sim and approaching headlights. The device is attached in front of the driver's seat, five or six inches back of the windshield. Made of purple, transparent material, it can be moved forward or backward and tilted from side to side. The color makes it easier to see traffic lights.

THE FIRST OF A SERIES OF ARTICLES THAT TELL YOU

What Your Radio Tube Does

LTHOUGH each year a seemingly new crop of radio tubes springs from the laboratories of the manufacturers, their bewildering technical labels refer in the most part to improvements rather than radical changes in the fundamental design. To the beginner in radio, the basic vacuum tube still a splass bulb containing three essential elements—a cathode, a grid, and a plate

Clearly to understand the first principles of modern radio, let alone the operation of the newer tubes, the amateur first must be able to picture what goes on inside a vacuum tube of the simplest design Least complicated of all tubes, of choise, is the early battery-operated type, but for the purposes of illustration the heater type of A.C. tube serves better since the current used to heat the cathode plays no actual electrical part in the circuit

Physically, the general purpose beater tube (type 27) consists of three concentric cylinders surrounding a small heater or filament as shown in illustration at right. The cathode, a coated metal cylinder which when beated gives off negative particles of electricity called electrons, forms the inner cylinder surrounding the heater. Outside this is a coil of fine wire called the grid, and surrounding the wire grid is a larger metal cylinder known as the piate.

The heater, or filament, serves only as a source of heat for raising the cathode to the proper temperature and for this reason can be disregarded when considering the actual operation of the cathode, grid

Let us suppose that by some magic we could stand inside a general purpose heater tube in operation. In the center, above our heads, we would see the red hot heater or filament used to heat the cathode which directly surrounds it. (In the illustration the plate has been folded back to show the

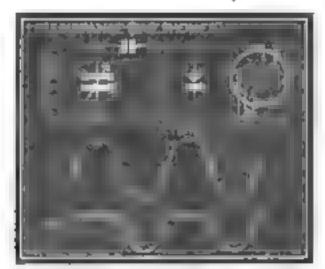


Diagram illustrating the rectifying or de-

construction of cathode and grid to Could we see and identify electrical charges, we would notice a beavy cloud extending from the outer surface of the cathode toward the plate. On closer inspection, we would not that this cloud is composed of negative charges of electricity or electrons and that some of these electrons are leaving the cloud and rushing rapidly toward the surface of the plate.

Like the negative pole of a magnet which is attracted by a positive pole, these electrons are attracted to the plate which by outside wiring, is made positive. To get to the plate however, they must poss through the fine wire coil or grid surrounding the cathode

Let us suppose that by some outside connection this grid is made negative. Being thus charged it will repel the electrons rushing from the cloud surrounding the cathode and decrease the Bow of electrons reaching the plate. Similarly since unlike charges attract, a positive grid will attract the electrons and increase the flow to the plate. Thus when an electromagnetic impulse in applied to an input coil connected to the grid, the voltage on the grid is changed and causes a change in the current consisting of the electrons flowing from the cathode to the plate.

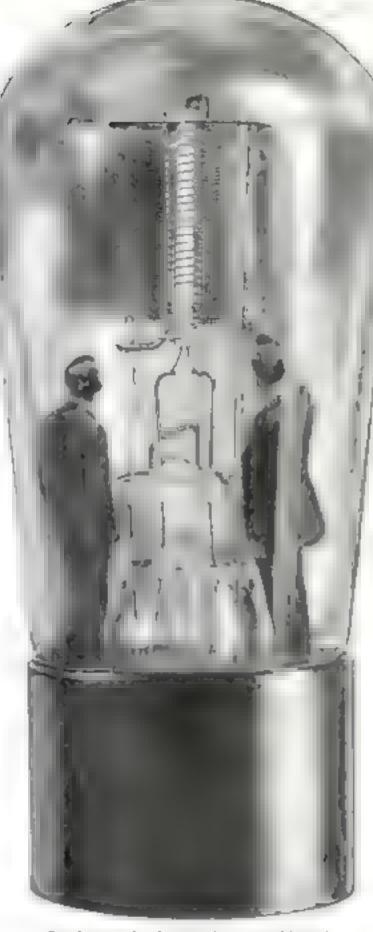
in its action the tube may be compared to a water system where the cathode is the supply, the plate the delivery end, and the grid a gate valve that controls the flow from the supply

A vacuum tube operates as an amplifier because the variations in the plate current produced by the input voltage to the grid may build up much higher voltages in a suitable transformer, loud speaker or head phones connected to the plate.

When used as a detector the vacuum tube has a more complex function, since it not only serves to amplify but also eliminates one-half the carrier wave and allows the audio variations of the other half to be further amplified and finally transformed into an audinic note

To understand the basic principle of detection, consider the elementary crystal detector circuit shown at the left

The action of the crystal detector is to allow current to flow in one direction only When the current is flowing in the right



Standing reside a heater tube, we would age the red hat frament in the course move our heads

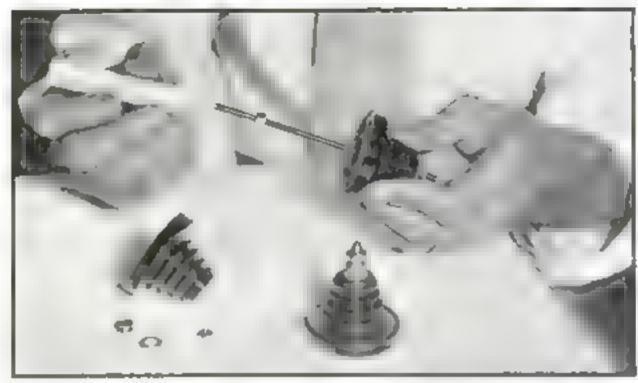
direction, it will pass through the crystal instead of the high resistance of the head phones. However when the current flows in the opposite direction, it cannot pass through the crystal so must pass through the head phones. In other words the crystal detector changes the incoming current from the alternating form illustrated at A to the uni-directional form B

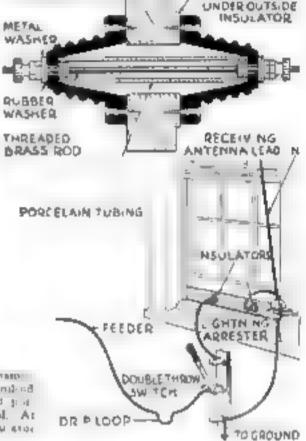
In the crystal detector, the energy supplied to the head phones comes directly from the signal energy and is merely charged in form by the detector. In the vacuum tube detector, however the energy which is supplied to the head phones is derived from the plate battery and is merely controlled by the signal energy through the action of the grid.

THIS is the first in a series of articles on radio for the beginner. The second article, describing the vacuum tube detector, is scheduled for early publication.

· Final Steps for Amateurs in

Getting on the AIR





MOUNTING BOADD

An inespective entering insulator for the transmitting amount feeder can be made from two standard passistors, a fength of threaded brane rod, and place are tubing. Bland-off insulator in foreground. At right, drawing shows crush-acction with of apputator.

short-wave receiver and transmitter and have obtained your Government license, you are ready for that long-awaited thrill of "getting on the air

Although a single antenna may be used for both receiving and transmitting, bothersome awitching may be eliminated and quicker two-way communication established if a separate, short receiving antenna is rigged at right angles to the

Careful insulation of the transmitting openina lead-in where it enters the house is an important factor in the general efficiency of your station. For this purpose, a large variety of feeder insulators is available, ranging from inexpensive porcelain tubes of the type used in ordinary house wiring to more expensive bowl-shaped glass insulators used when it is desired to bring the feeder through the glass of a window pane into the reception room

The amateur operating a small station, however, can assemble an inexpensive entering insulator from two stanti-off insulators of the better grade, a suitable length of threaded brass rod, and a piece of poccelam insulating tubing. As shown in photo and diagram at too of this page, a separate bard wood board, placed between the jambs of the window in the manner of a removable screen or yentilator, serves as the mounting. The board should be about 8 in, high and 1 in thick.

To assemble an insulator of this type, first remove the regular bress terminals from both insulators. Then

mount one insulator directly over a \$2+ or 1-in bole in the mounting board and fit a suitable length of threshold brass rod with two sets of lock nais as indicated Next insert the rod, place the porcelain taking over the rod, mount the second insulator on the other side of the board and screw the terminals nuits in place. The porcelain tube should just be long chough to fit snugly between the stand-off insulators when they are in place (see sectional view).

For protection, your receiving antenna should be equipped with a lightning arrester while a single-pole, double-throw switch installed in the transmitter feeder will serve to ground that system when it is not in use. To prevent rain water, that runs down the feeder, from reaching the switch, place a U-shaped bend in the wire

Above suggestion for radio log an re-

2 Above, suggestion for radio log an re-

about a foot or more above the switch. It was have selected the type of transmitting antenna that requires two feeders (PSM., Aug. '32, p. 65), it will, of course, be necessary to install two antenna switches, one for each feeder. Also, since both feeders must be paramel at all times and the same length, some system of keep-

ing them taut must be supplied. This may be done by connecting both feeders to the antenna system in the manner illustrated in Fig. 3. The so-called "unconnected" feeder is attached to the system between two insulators

Listening in on your shortwave receiver, you probably have learned that a definite procedure is followed when one amateur tries to get in touch with another. Thus procedure consists of repeating the identification letters of the station several times, sending the letters DE, meaning "from," and then the call letters of the station sending. In practice, this call is repeated four or five times and is followed by the letters AR, another abbreviation meaning the end of the message.

Common "Q" Signals •

QRA?.. What is the name of your station?
QRA The name of my station is

QRI ?.. Is my tone bod? QRI Your tone is bad.

QRL ?.. Are you busy? QRL I am busy.

QRM? . Are you being interfered with?

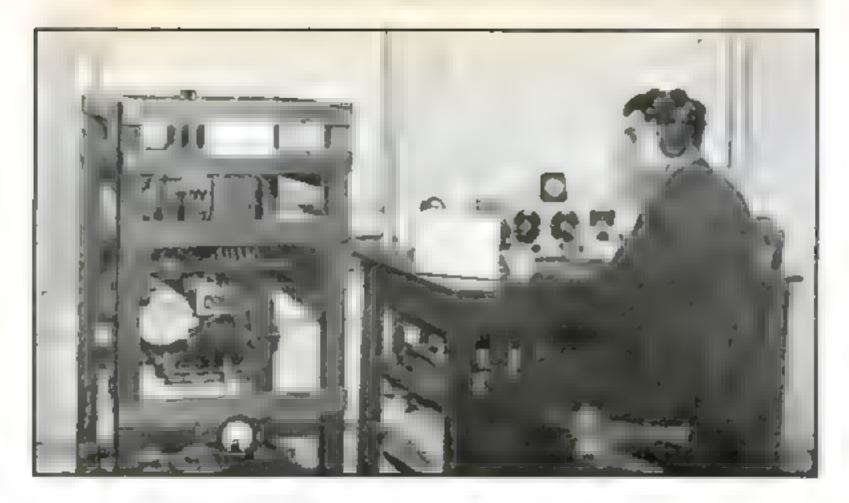
QRM . I am being interfered with.

QRT ?., Must I stop zending?

QRT , Stop sonding.

QSL P.. Can you give me acknowledgement of re-

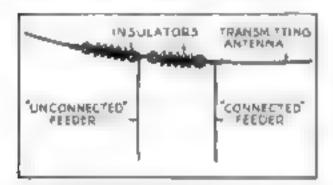
QSL I give you acknowledgement of receipt.



By John Carr

A typical continuous wave station operated by an amultur Notencet or angoment of equipment and the obsence of visible wiring

Following a Definite Procedure Helps When You Reach the Thrilling Moment of Making Your First Call with Your Own Set to Far-Distant Stations



3 In two feeder systems, both feeders may be hept taut by connecting them as indicated

knowing perhaps only a few owners of short-wave stations, your first job as an amateur will be to make acquaintances through the air by listening for "CQ calls. This call, which is used by amateurs when they want to talk with any station willing to make con act with them is made by sending the letters CQ the letters DE and the call letters of the station sending

Generally, the letters CQ and the call letters of the station are repeated three or four times and the complete call is sent for a period of three to five minutes. If you desire to make contact with a CQ log station, you listen for his call letters followed by AR and then call him back in the usual manner by calling his station and signing the call letters of your station.

According to a rising of the Federal Radio Commission, every amateur must keep a complete and accurate record of the operations of his station. This log must include the time the power, and the frequency for each entry of a station worked. A log book can be anything from a cheap paper-covered notebook arranged in convenient columns to an elaborate loose-leaf affair using prepared pages which can be purchased at most tadio supply stores. Many amateurs even go so far as to maintain a convenient card file of all the stations worked, listing remarks that may be valuable for future reference.

Before the amateur does any actual

If it is not followed by a question mark, it indicates that an answer is being given. Complete lists of abbreviations and Q signals are given at the back of most handbooks for amateurs. However, for those who do not have such a list, common Q signals are listed on the page opposite

If it is necessary to keep your transmitter on the air while the station you are working makes adjustments use a repetition of the letter V. This is the common test call and is generally sent for a period varying from one to five minutes. If an operator wants you to send a test call, he will indicate it with the signal QRV.

Testing Your Condenser

OFTEN the radio fan de siring to construct a receiver from acrap parts salvaged from old sets, finds that the variable condensers he has are not of the required capacity. If these condensers have a capacity greater than that desired, they can be made to serve merely by altering their construction

The capacity of any condenser d pends on the number and area of the conducting plates, the dialectric used between plates, and the distance between plates. Although altering any one of these conditions will alter the capacity, it is easiest, on a variable condenser, to reduce the number of plates. It is not necessary, however to remove both the stationary and corresponding movable plates. Remove either one or the other until the desired capacity is obtained—the reduction being proportional to the number of plates removed.

A large fixed condenser can be tested by connecting it in series with a battery and a volumeter. If the



Dreiting is in section with battery and volumeter Momentary deflection means the condensor at a good one

voltmeter shows a momentary deflection, the condenser is a good one. If a constant deflection is noted, the condenser leaks. If the full voltage of the battery registers, the condenser is shorted at some point

A condenser can be tested quickly by placing it momentarily across the terminals of a battery. A pair of phones connected across its terminals will give a chick if it is in good shape and known not to be short-circuited.

Anti-Freeze Problem SOLVED BY FIRE AND BLAST

BRISK wind whistled an acy tune as Frank Gordon closed the radiator shutters on his car and started on his morning drive to

his office.

"Must be be ow freezing," be thought as he pulled his overcoat higher around his neck "It a a lucky thing I put some alcohol in the radiator last night."

As his car hummed along the road, Gordon chuckled with selfsatisfaction each time he passed stalled cass with steaming radiators. For once in his ble he had outwitted the cold weather and put his alcohol in shead of time

Suddenty, as he neared the cen er of town, there was a blinding flash and a loud report. For an instant, the front of Gordon's car was a mass of flames. Daged and frightened, he shut off the ignition and brought the car to n squealing stop.

Advice came from all quarters. l'assing traffic hastened to get out of his way and shoppers excitedly tried to move their parked

cars to safety

Grabbing the fire exunguisher mounted under the seat. Gordon jumped to the ground and cautiously lifted the blackened hood To his surprise, not a trace of the

flames could be seen. Instead water trickled from a long gash in the top radiator connection. The tongues of blue flame that had enveloped the hood but a moment before had died out as mysteriously as they had appeared.

Completely puzzled, Gordon chanced driving the car the short distance to the Model Garage where he related his uncanny experience to Gus Wilson and his

partner Joe Clark

"And you say for an instant the front of the car was a mass of blue flames?" anguired Gus when Gordon had told as



For an instant, the font of Gordon's car was a mess of flence. Orabbing a fire entinguished he jumped to the ground and can one y blied the b schenod hood

best he could just what had happened "What've you been using in the radiator -dynamite?"

Nope," Gordon replied, "just the old stand-by mixture of alcohol and water But what's that got to do with it?"

"Plenty," backed Gus. "From the looks of this base connection, pressure high up in your radiator. Something had to bust, and this was it," he declared.

Scratching his head, Gordon watched Gus pour water into the radiator, "But how can pressure build up in a radiator when there's an averdow pipe to let steam

escape?" be asked, pointing to the tube in the radiator.

Gus said nothing, but continued to fill the radiator He grinned when the water reached the top and spilled over the edges. Beckening to Gordon to look down into the radiator be said, "The water's way above the top of that overflow now but it doesn't run off In some way, that pipe's got clogged Your motor heated up because you forgot to open the shutters and the alcohol boiled off and couldn't es-

cape. After a while, the pressure got strong enough to blow right through the rubber hose and your hot mater-al. soaked, too, with gas and oil—was sprayed with hot a cohol vapor. You're just plain lucky you didn't burn your tar up."

"But how did the pipe get clogged in the first place?" inquired Gordon. "Dirt would have to be jammed in there pretty tight to stand more pressure than a rubber

"It was ice that caused your trouble," Gus pointed out. "Some dirt probably got caught in there—rust or sediment from your cooling system. Then, when you filled your radiator, water codected over the dirt and froze solid. Have you ever tried to pry ice loose from metal by pushing it when it's frozen solidly?"

With a long piece of stiff wire Gus prodded the overflow pipe. "You see." he said, "now that the ice has melted it a easy to push through the dist. Speaking of dirt," Gus added, "judging from the stuff that's come from your radiator I'd say it's pretty dirty. Ever clean it out?"

Gordon shook his head, "Never thought

I had o he repued

Tha 5 why your motor overheats" said Gas. "Dart and rust form a scale on the inside (Continued on page 110)

GUS says:

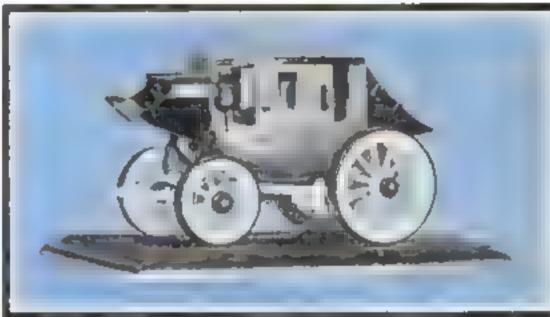
Don't forget that your steering mechanism, brakes, tires, and head-lights are just as important as your motor It's nice to have a motor running smoothly, but if it suddenly fails, it won't put your life in danger. Check the major safety features on your car periodically and don't forget that the windshield wiper, horn, and stop light are important when you need them.

BETTER SHOP METHODS: IDEAS FOR THE HANDY MAN: BLUEPRINTS



MODEL MAKING : HOME WORKSHOP CHEMISTRY : THE SHIPSHAPE HOME





With its vermilion body and yellow carriage this tiny model of the D amond Tally Ho is a beauty of occament, whether manding a one or set on a box

A unique new way to solve your Christmas gift problems without spending much money for materials

MAKING Miniature Coach Models

IFTS that carry with them something of the personality of the giver and are at once unique beautiful, and mexpensive can be

made by taking advantage of the present vogue for roath models and building thry miniature coaches. These may be used either as ornaments in themselves, as decorations for boudeir boxes, or as nigarette

containers.

Any coach model plans will give data on which to base the miniatures. To ornament the glove box shown in the photograph at the left above. I chose the Diamond Tally-Ho from the Popular Science Mouritry series of models, and for the cigarette container illustrated at the bottom of the page, a somewhat larger model of a covered wagon. Because of the possibility of their being roughly bandled, some of the ports

are enlarged in scale; but the general proportions are accurate, and the little boxes tinged as they are with the glamour of the old West, are genuinely beautiful



Cognectes are ejected from the end of this covered wagon

The stagecoach model, too, if made a little larger with the window openings covered inside and the top removable, can be used as a jewel or match box, and, of course, the covered wagon, somewhat reduced, could be mounted on a little chest. The "Buffalo Bill" Cody type of coach, by the same methods, would work out well.

When building the Diamond Tally-Ho ministure, rough out the parts from close-grained hardwood, and trace the shapes on with carbon paper. The center of the body, together with seats and boots, is parsawed from one piece of wood, the ribbed upholstery being indicated by nar-

row grooves. As the dashboard projects beyond the fore bootsides, the driver's seat and boot floor are recessed at the sides, where pieces of thin celluloid, cut from old photographic negatives, are glued on with household celluloid cement to represent the leather sides.

After cutting the body index, acribe guide lines on the edges and carve the vertical curve, then the horizontal, finishing all smoothly. The outsides can be roughed on a sanding disk in short order, and the insides hollowed with a sanding drum, if machinery is available. The paneling is outlined with groover.

Make the top slightly crowned, hollow it lengthwise inside, and fit it to



The parts of the coach body. These may be on from any close grained hardwood. Note how the uphot story and coof batters are indicated by fine grooves

The underside of the carriage is shown in the rectangle. The wheels are astuned on with No. 18 heads. In circle. The jig-sawing can be done asther by hand or machine

the sides. Cut thirteen grooves on top to simulate protective battens

The three reaches are made individually, but the fore holster and axietree are fig-sawed from one piece, with a groove dividing the two. Drill the bolster to receive puns for attaching the reaches, and hore 1 16-in, holes in the axietree to receive the bound side arms

The hind bolster and axletree supporting the hind brackets, are separate pieces. A straight cross member above the reaches behind the fore bolster carries the fore bracket braces

Assemble the hind axlettee brake beam, and cross member with the reaches, gluing the joints

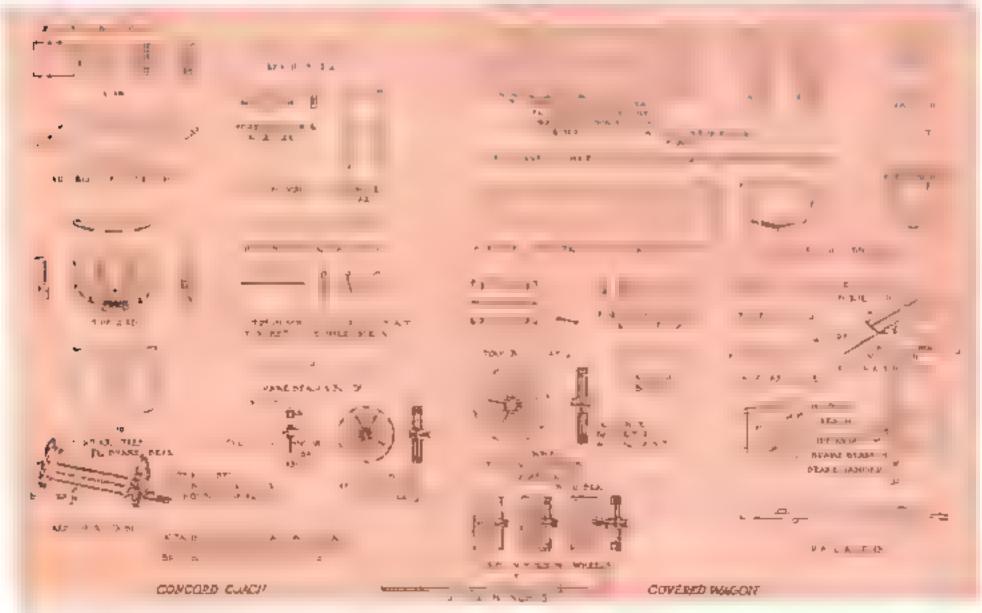
and strengthening them with pins driven in holes drilled to receive them. Add the bolsters and hound parts.

This sheet metal is used for the thorough-brace brackets, which are bent to shape with phers. I used steel hair curlers and drew the temper by heating the material red-hot. Caluloid cement in itself is sufficient to hold the brackets in shape

Before assembling the body, paint the upholstery, floor, and interior below the windows light green. Above, use dark vermitten of the shade to be used outside.

If necessary, after the body is put together, work off the edges of the top to follow the curve of the sides, for the edges project only 1/32 in

To represent the folding of the boot cover over the bind boot sides, cut celluloid

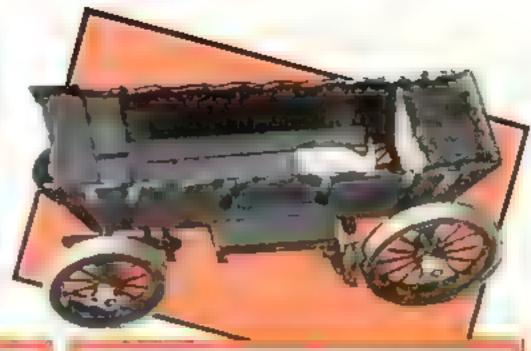


Working drawings of both the stagecoach and the covered wagon. The dimensions of every part can be found easily by reference to the loch scale



R ght The averaged way a with he premove Faine how ends a e as aned to the bin soits to match these on itself which as carved on soit pine.

Left Turning a wheel blank in the lathe. A re-



strips to be comented or The tour careboard see each side—lap over these

Recess he forward underso
the fore boot and dash to a
the effect of cleats. Cut cellule I
o extend a lattle above the scat
and paint the insides hack before
the end seat aprons
pear as careboard stops g
o the boot suces

The wheels can be turned and built up with brace for spokes more quickly and easily than by other me buts, and this construction is very ranged. A tach to a lathifact pate, or her with screws or a wangen chark curne.

a block of soft pane about 2 by 2 by 4 in. Turn to the diameter of a wheel and sand. Then working from the face, shape the hub and

turn the fellor, recessing deeply for the spokes. Leave a little stock inside the fellor for turning off after drilling for the spokes, thus crasing any splintering. Also drill the spindle hole. Scribe a pencil line on the tire to center the spoke holes, with a similar line on the bub.

Remove the facepate from the lathe and drill the felloe holes with a No. 18 brad. Insert 1-in, brads, thrusting the points lightly late the hub, on the guide line or beside it, according to its chance position as established by the first spoke, with due regard, of course, for dish in the wheel. Tap each brad lightly with a hammer to force the point into the bub cut off the projecting head, and drive the end flush. Then replace the work on the lathe, turn the felloe loose from the block behind, and shape the inner end of the hub. It is now ready to be cut off

When all the wheels are made, fastent a block of wood to the faceplate and turn a depression 1/2 in, deep and large enough to take a small wheel when pressed firmly in. Insert the wheel, outside in, and dress the fellos to form the tire projection. Finish the other fore wheel; then enlarge the chuck to take a hind wheel

Use 1/64-in, stiff brass wire for the top rating, soidering it at points of contact.

A glass head or a box made from clear celluloid, topped off above and below with wooden caps, will serve for a lamp.

For painting I used quick drying enamels and varnish, applied with a 1/4 in flat sable brush and a 1/16-in, round brush. The body, boot floors, and driver's seat aprons are red, boot sides and cover, lamp frames,



ant a R ght E



railing, thorough-braces, brackets, tires, and hub bands, black; carriage, yellow, panel striping and proaments, git

A box about 454 by 9 by 346 in, is a good size for the coach mounting. I built mine of rosewood veneer, repeating the coach colors in red and gilt stripe inlays and in black feet. The coach platform is black. The box is fined with blue velvet

Mount the model with the lower edges of the wheels a little closer together than the upper. Scrape off enough paint to box and each wheel, so that glue can adhere. Reënforce with a wire looped over the fellow and twisted under the platform.

The general construction of the covered warms in self-aviidant. The giventure 60.

make wond-to-wood contact between the

The general construction of the covered wagon is self-evident. The cigarettes fill the wagon and are removed one at a time by pulling the ejector knob in the front end of the box near the bottom. This draws out a cigarette through the hole immediately above the knob. If preferred, of course, the "canvas" part of the top, which is really wood, could be hinged to the wagon box—a better arrangement for the many smokers who are prejudiced against semiautomatic ejectors of any kind.

The bottom of the container is a celluloid trough supported underneath by tross strips, which have their flaps cemented to the sides of the wagon body. Carve the top from a pine block, and fit the sides against the irregularities of the lower edges. False bow ends are glued to the sides

Mount the wagon on a base 3½ by 6½ in. Paint the cover light ivory, with faint tints of other colors here and there, and antique the rest by painting it dark gray over which red poster paint is coated, with yellow other in the joints. When dry scrub over with a still brush, and give one coat of varies thanned with an equal amount of turpentine. Indicate weathered grain with streaks of flat Vandyke brown, and use this color in the cover openings and on top of the box ends

To lead the box, remove the top, invert, and fill with cigarettes. Close the box in the same position; then set it upright

HOMECRAFT GUILD Kits for Christmas

F THERE is an amateur me chanic in your family, you could not find a better Christ mas gift for him than one of the Popular Science Homecraft Guild construction kits. These are described on page 104. The furniture kits marked Nos. I to 4 are especially suitable, the parts being machined and prac-tically ready to assemble. They are in fact, designed for begin ners; but the advanced worker, too, will find these kits most satisfactory because the materials are complete, even to hard-ware and finishes, and all the difficult, tedious, and umnteresting work is already done

Comfortable T-Shaped Leg Rest Is Self-Adjusting

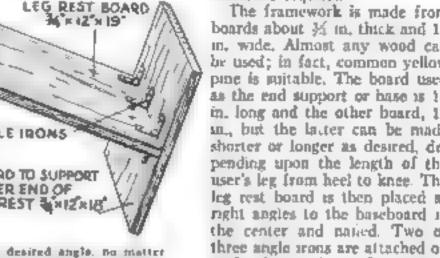


MEN who like to stretch out in their favorite chair with a newspaper or magazine will find a leg rest of the type illustrated surprisingly comfortable because it adjusts itself to any angle. Two boards, four or six angle irons, a few rails and screws, a box of tacks, and some strips of carpet or other covering are all the

materials required

The framework is made from boards about 34 in, thick and 12 in, wide, Almost any wood can be used; in fact, common yellow pine is mitable. The board used as the end support or hase is 18 in, long and the other board, 19 un, but the latter can be made shorter or longer as desired, depending upon the length of the user's leg from heel to knee. The leg rest board is then placed at right angles to the baseboard in the center and natied. Two or three angle irons are attached on each side to make the frame rigid.

To cover the wood, strips of carpet are cut out, sewn together, scipped down over the leg rest board, and tacked to the baseboard. Other strips are then tacked over the baseboard section. In the absence of carpet, other upholstery ma-

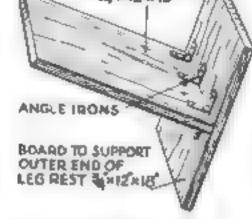


terials could be used.-IRL Gordon



AN AID IN TOENAILING

SMALL, light pieces of wood that have to be toenailed in place always have a tendency to slip, but they can be held just where you want them with the aid of a common, heavy rubber door wedge. The soft rubber will not slip, and it keeps the piece squarely in place,-F W B.



This leg rest is batter than a footstool because it supports the legs at any desired angle, no matter how far one wishes to stretch out while lounging in a their. Only two boards are needed for making it

WISTFUL PUPPY HOLDS CIGARETTES

THIS wistful look, catches the eye of every of his melancholy counterhe is really a very meful anima-He holds cigarettes, matched cards, or any small articles. His body consusts of a box closed at each end with pieces cut but to represent the shoulders and haunches of a dog The cover extends over at the rear to form a tail and incidentally a handle The Inside dimensions of the compartment are 4 in long. 234 in, wide, and 134 in, deep. The over-all dimensions are, from tip of hose to sip of tall, 9 in height, 755 in.; we the The head is fastened to the body with a single actes The eyes are pushpins enameled white-K M.



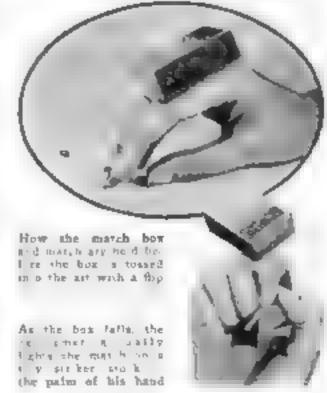
OCTAGONAL RODS PLANED QUICKLY ON JOINTER

WHEN it is necessary to plane a square stick to an octagonal shape on a jointer, first set the fence at 45 deg, and bevel the edge of a piece of waste 1 by 3 in, stock, Clamp this guide piece against the fence as shown to form a trough in which the work can rest with no tendency to turn over. Take one cut at a time on each corner. One stroke over the jointer will finish each corner of a small rod -E L.

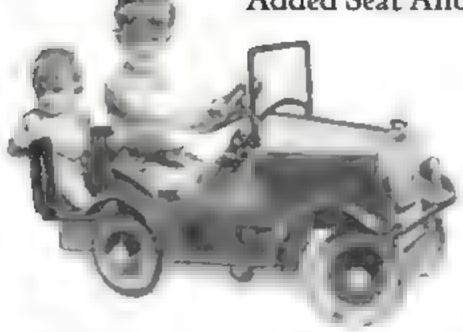
EASY MATCH TRICK BAFFLES ONLOOKERS

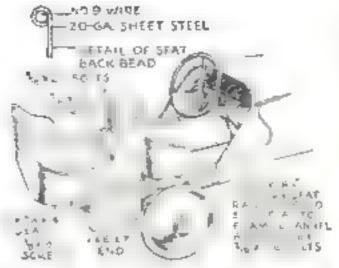
Known as the "strike-out match trick" -a bit of magic that seemingly depends on pure skull—this simple little stunt is optly named it always "strikes out" anyone else who tries it. A box of safety matches rests on the back of the hand, and a single match is held between forelinger and thumb. A tosa sends the box into the air At the same moment the performer lights the match by striking it on the rapidly falling box. He never misses, but others trying the stunt always do.

Cut out a small square of the striking surface from another box and smear the back with a sticky substance scraped from warm adhesive tape to that it can be fastened firmly to the palm of the hand. With very little practice you can manipulate the match so as to strike it on the palm at the moment the hand touches the failing box. The rapid movement of the hand makes it impossible to detect this bit of trickery.-George S. GREEVE.



Added Seat Allows Two Children to Use Toy Auto JOHN CCA. ZO-GA SHEET STEEL ETAIL OF SEAT BACK BEAD





The method of making the seat is shown above and the actual untialistion appears in the photograph

EVERY boy who ewns a toy auto will have much more fun playing with it if it is equipped with a homemade numble seat so that he can take a little friend along to keep him company. As shown in the drawing, it is best to make the rumble

seat as nearly as possible a duplicate of the original driver's seat of the toy car

The extension is supported in cantilever fashion on two scrong bickery seat rails inserted into the steel frame channels of he car and fastened with bolts. A sort

of tin box is provided for the youngster to rest his feet in, well. protected from the cranks of the rear axle shaft. The exposed edge of the tin that forms the back of the seat is beaded around a piece of No 3 wire This beat is made with phers and a ball peen hammer while the sheet metal is still flat The corner bends

are made afterwards. Avoid any square corners or sharp, turny edges that might cause injury to case of a spul.

After the seat has been strongly screwed and bolted together, it should be given two coats of auto enamel - STEWART ROUSE.

QUICK DRYING GLAZE FOR CARDBOARD

A VILVIT gloss finish or glase can be given sheets of cardboard and sundar materials with a solution of sodium silicate or water glass. The process is a simple one and takes so butle time that it can be used for many purposes for which a more expensive finish would not do

To each pint of the solution add one teaspoonful of pure glycerine and mix thoroughly. Apply a small quantity on the cardboard with a brush, and immediately smooth it out with a rubber roller so that it forms a thin film. The finish dries in ten seconds and can be bandled at once The Illustration shows the appaication of the compound to the face of a penny picture post card in order to make it look more like a photograph.--- V B.C



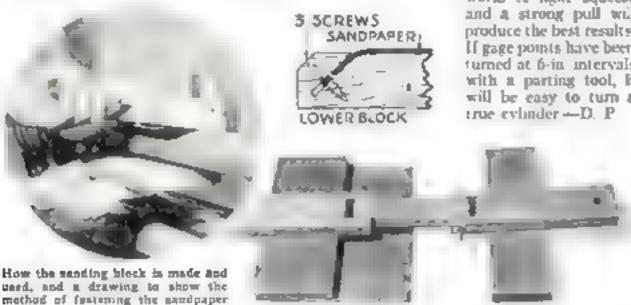
CLAMP FOR SANDPAPERING CYLINDERS

IN TURNING a true wooden cylinder of exact diameter-no easy feat for the amateur-the use of coarse sandpasser held against the work between two blocks of wood is a great help. The sandpaper horder idustrated is a development of this method.

The pressure blocks are of straight 13 16-in, material 0 in, long, the upper one about 3 in, wide and the lower abou-

4½ in, wide. They are screwed to 13-16 by 252 by 8 in. bandles, and these are connected by a 13/16 by 1 by 6 in. link which has 34-in, holes bored at 34-in intervals for metal pins--in this case [4-in] cotter pins. The sandpaper, of coarse grade, is claipped in the front edge of the lower block, as shown in the drawing The purs are so adjusted that the handles are not quate parallel when placed on the

work. A light squeeze and a strong pull will produce the best results. If gage points have been turned at 6-in intervals with a parting tool, it will be easy to turn a true cylinder -D. P.



DRILLING JAMMED LEAD OUT OF A PENCIL

LEADS sometimes Jam in automatic pencits, Several times I paid a jeweler to drill the lead out before Libscovered that a simple but effective little dril. could be made at hame from the wire of a meetum sized paper clip, which is slightly smaller than the lead in an ordinary automatic pencil,

Take one of these clips and straighten but the tirst and second bends of the long side, leaving the short sale bent to act as a handle



A straightmocd out paper clip is used to remove the lead

Flatten out the tip with a file or by striking it with a hammer on a hard surface losert this tip in the end of the pencil and turn with the fingers, using it as a drill. If the wire is removed at intervals and the dust poured out, it will be found that the jammed lead can be cleaned out quickly and effectively, leaving the pencil practically like new.-W. G. HAMMOND,

DUAL SANDING ROLL

WHEN finishing pieces on an ordinary wooden sanding roll of the type generally used in the lathe, it is verations to have to stop and change from coarse to fine sandpaper. To obviate this, turn the rol. with a raised bead or ridge in the center, dividing it into two balves. Fasten the coarse sandpaper on one half and the fine sandpaper on the other half. The head prevents accidentally scoring a nearly finished piece by moving it onto the coarse sandpaper, yet both coarse and fine sandpaper are available.- C. F. BLAKE.

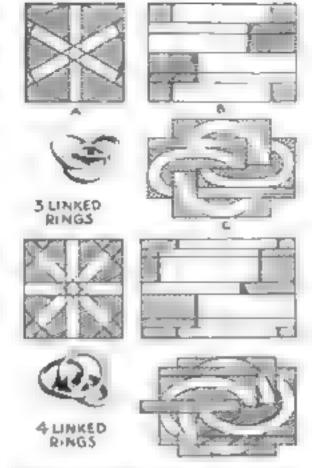
HOW TO WHITTLE INTERLOCKED RINGS



Henz, whittlers, is a test of your skib Can you cut one block into three or four rings, each linked into the others?

Hetter practice with three rings first All you need is a small block of mahogony or walrut, 2 by 2 by 3 in. Mark on both ends as shown at A and cut away all of the shaded parts. Now mark it as at B and again cut away the shaded parts, leaving a figure like the one shown at C, as If three thin rectangular pieces were set at an angle so that they project half-way through each other.

Cut out of cardboard or thin sheet metal a template for marking the three circles. With a small, sharp thisel carve away the corners outside the circles. Next cut away the inside of the rings, but be very careful not to cut into the rings. Look as often in back of the work as in front. When the rings have been cut free from



Steps to cutting the tings and photographs of the three and for ring combinations

one another, round them nicely with a chisel and smooth them with sandpaper. Stain and shellar them if desired

Next try the four rings. You will need a block 2 by 2 by 356 in. Proceed as with the three rings, but be careful to have 36 in, between the two outside rings where they cross each other, because this allowance will make it easier to cut them apart.—William Harvest

WOODEN LETTERS SPELL CHRISTMAS GREETING

LIGHT, fragile pasteboard letters are not altogether satisfactory as part of the Christmas decorations. Heat, cold, and changing conditions of moisture frequently make a sorry mesa of them. It is better to use the next toy wooden letter blocks that can now be so inexpensively obtained. These are coated with soft point, and small screw eyes are in-



Part of a "Merry Christman" sign made by bang og golded wooden o tera on a string

MUSLIN COVERED FRAME AIDS IN BENCH WORK

If you have to repair or assemble a model or any mechanism having many small, delicate parts, try this method of preventing any of them from being tropped and lost. Make a frame the depth of your bench and 18 or 20 in, which cover the front two thirds with mustin, fastened securely but not pulsed tight; it should bag a little. Fit slides under the bench top for the frame When handling small parts, pull out the frame so that the cloth will catch anything you drop.

Our BLUEPRINTS Will Help You

IF YOU intend to make toys or novelties for Christmas gifts this year . . . If you are going to start a new model . . . if you wish to construct a piece of fine furniture . . , if, looking forward to vacation days, you intend to build a boat or canoe , , , if you desire to assemble a radio set . whatever you plan to do next in your home workshop, the chances are that we have blueprints which will give you the information you need. Look up the partial list on page 90 or send a self-addressed, stamped envelops for our complete list.

The experienced mechanic knows that good work camot be done without a good plan. It is only the beginner who rushes shead without a drawing to guide him, and he often pays for his rashness by discovering when too late that he has overlooked some assential detail. There is no need to run this risk when so large a variety of blueprints are available.

RACE TRACK GAME MADE ON JIG-SAW

Drop a ball min the entrance hole of this homemade race track game, let fly the trigger, and the ball spins around the track. Five steel ball bearings are allowed each player, and there are twenty-six pockets in which each ball may come to rest, providing it does not bit one of the "traps."

Figure 1 shows the shape of the board and

how the center is removed at a 20-deg, angle on the scroll or jug saw. The "traps" are brain nails staggered on the slanting track as in Fig. 2. The cut-out board is glued to another board of the same shape in which 1/2-in, pockets are bored as in Fig. 3. A small disk is then glued in the repter and a parrow flange placed around the tim of the track so that the

balls cannot jump out
The tragger is like those used
in marble game boards.— K.X.

Fig 1 Cutting nut the rim of the race track with the table of the acroll naw tilled at a 20-deg, angle

F.g. 3. The completed game has thirteen numbered he es giving from 1 to 900 points. All the committing pockets are blank

Driving

nath in the rim

to form "trage"

Piz



Battleship Model U.S.S. TEXAS



By Capt. E. Armitage McCann

Texas (P.S.M., Nov. '32, p. 67) and intend to build our new 3-ft, model of her—she is flagship of Battle-ship Division I of Battle Force, U.S. Fleet, and was long famous as flagship of the A lantic fleet—will construct it for exhibition purposes. For those, however, who wish to make a working model, a few auggestions in regard to the power plant

should be added.

Captein McCean with his model which is run by a storage battery and electric motor

If an electric motor is to be used, it is well to gear the speed down to about one third. For this 8 38-in, spur gear (cog wheel) on the motor shaft and a 11/8 in gear on each shaft will serve. But the 1/4in, gear on and lay the other two on the bedpute so that their teeth engage each other but only one engages the small gear. They will therefore turn in opposite directions, either above or below the center shaft. Drill 1/8-in, holes at these positions Turn up the bottom of the bedplate to a little less than a right angle so that gear wheels and motor are clear of the bottom, and drill it for wood screws, Now bring up the shafts to go in their boles. Fasten down the motor, noting that for the shafts to be parallel the motor will be slightly to one side and tilted towards the stern. It will go at the rear end of the opening which is to be cut as shown in the deck.

Get the tubes accurately in line so that the shafts turn quite freely, and fasten them there, leaving about 76 in projecting outside and filling in between them and the hull. The inner ends of the shafts should be threaded for outs or have holes drilled for wire cotter pans. The gears are either soldered or keyed to the shafts.

The outside ends of the tubes should be filed quite flat and smooth, and the small pieces previously cut off are bored unside to a conical shape so they will

engage the ends of the tubes and act as stuffing boxes to keep the water from entering. Solder these in position when the gears are engaged and the inner ends of the shafts run free in their bearings, Cut off the outer ends of the shafts to the right lengths so that the propellers will not quite touch the struts and their cen-

ters will be in line with the rudder trunk. This latter is important to allow the rudder to swing.

For a switch, I used a small revolving car switch and placed it in the second barbette with the end projecting through the turret, where it looks like a ventilator. The wires lead through the deck to the

battery and motor

The bilge keels may now be fitted. The position of these was indicated on the sheer plan last month. It will be noted that there are two short ones on each side? Out mine from sheet brass, leaving a long prong at each and as shown at G in the drawings on page 72. A kinife cut is made along the bull in which to fit them, and a cut is run right through for the prongs, which are bent up inside. They should be 1/4 in, wide, although I gave mine an extra 1/4 in, for stability. Although actually straight, they form a stream line when on the bull.

Before putting the deck lift back in position, a hole must be cut in it to get at the machinery (for a working model). The area of this can conveniently be made just a little less than the upper deck and



A view of the superstructures, dech fittings and forward turrets. Note the casemates cut into the upper part of the holi-

engine-room fiddley. I cut the opening with a fret saw, held at a slight angle, to the line shown on the deck plan. If cut with a fine saw, this joint, considering the overbang of the deck above, will be sufficiently tight. I then cut away the was e as increated by the inner line, to save weight. This rim later will be glued to the upper deck and will lift out with it

The deck lift should now be glued and nailed on, the position of all the fittings marked, the casemates in the niles cut and the projecting midship wing pieces I

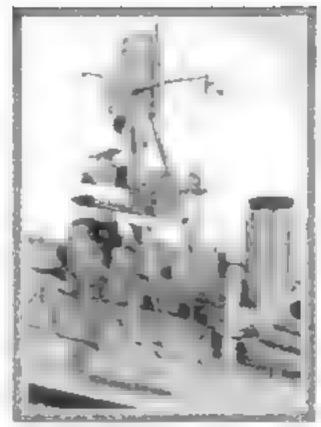
cut and fastened

The rudder H (shown last month) is next added. The post is a piece of hi-in, rod, for which a hole is bored through the skeg and up through the deck. The lower end is cut down the center, and the sheet brass rudder is placed in position through the slot in the post and soldered. To hold it in any position, as is necessary with a working model, I threaded the top end and on it fitted a little capstan (64) If it is not to work, then shift the capstan to its right position just forward of statuon line No. 9, and do not bring the rudder-post through the fleck.

The hawse pipes should be large enough to take the shanks of the anchors—about 1/2 in. Make small holes first and hore up and down to get both ends at the right position. The hawse pipe lips can be rims of brass tube or be fashioned from plastic material. The upper ends (3) can be of similar material or brass plate. It will be noted that there are two auchors on the port side and one on the starboard. The anchors themselves should be of the Navy (stockless) type as shown in detail 62. They may be purchased or made from lead or brass. The cables should be black chain with about 11 links to the inch.

The towing colors (2) are 3.32-in holes cut through the hull at the deck level, the upper part of the rim extending above the deck level. They are made of plastic material or of brass tube filed to shape

The three capstans should be turned from brass or wood to the shape shown at 4. The lower part is in reality a gypsy to hold the chain as the capstans turn, this can be disconnected and the top used for a rope, They work on beds in which

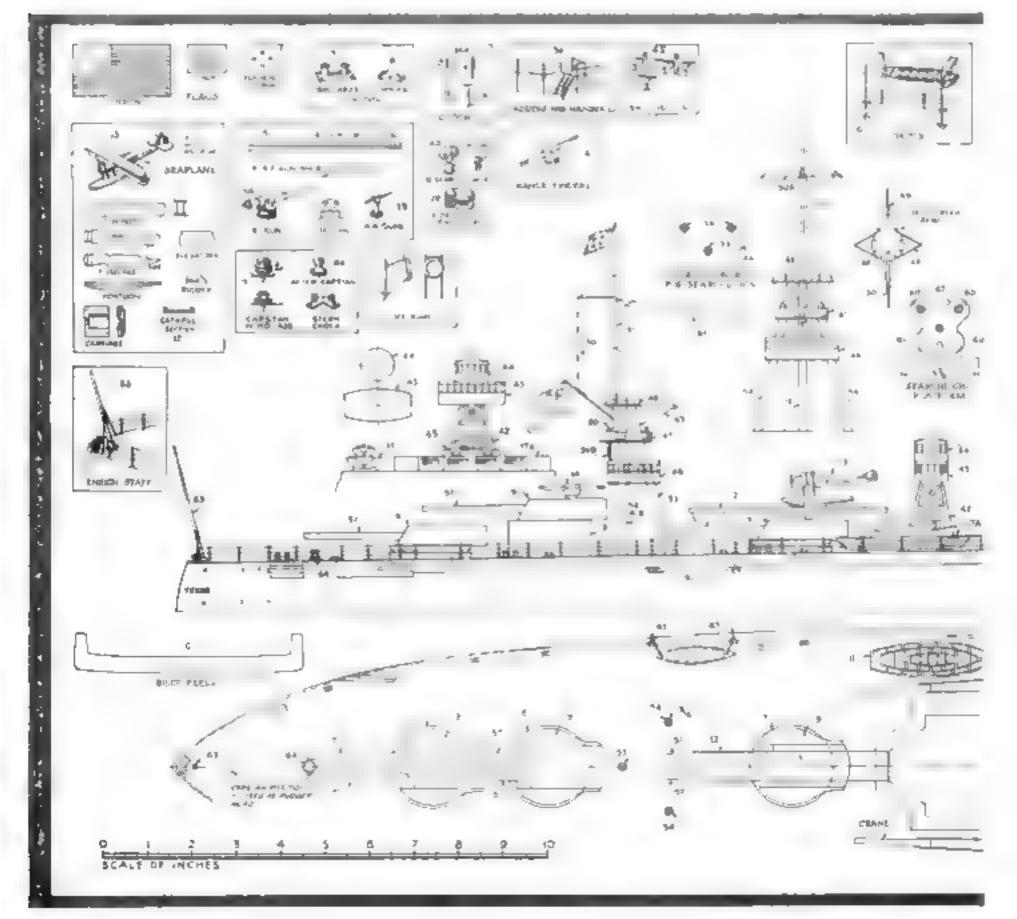


Poremant with potting and radio rooms purot bounce control stations, and battle ups

there is a bole (chain pipe) through which the chain goes below. After putting the chains down, I closed the boles with plastic material to look as if they had covers on.

The deck should be lined to represent deck planks before putting anything on it. I do this with a very sharp, hard pencil and straightedge. Lines about 1/16 in apart look best

The lower bridge houses (captain's quarters) and upper deck 17 are cut from a piece of 1/2-in, wood. The deck should be plank-marked. The three casemates on each side are cut, and the portholes and doors are indicated as in the drawings. For portholes on this model, I sharpened the edge of two pieces of tube of the right size-1 16 in, for the outboard parts and 3, 32 in. for the inboard-and lightly tapped these in the wood to make circular indentations, afterwards painting the rims and filling the space inside a light blue color. The model undoubtedly would look better, however, with real air ports, either made or bought. There are 36 large and 146 small. I just painted on the doors and windows.



72

On this deck there are two nouses 18 and 19, also cut from 1/2-in, wood. They should be painted before the deck above is

set in place.

The next bridge deck (20) I made from 1/16 in, fiber board, but 24-gage brass would have been better, because with it you can have the stanchions closer to the edge and solder them in position, if necessary. Its shape will be seen in the detail. It should be drilled for the stanchions before being placed. On it goes the conning tower support (21), a little deck 22, and above that the conning (ower (23), which instead of ports

has narrow slots and three small ventiletors on top. Abaft that are the plotting room (24) and the radio room (25). All these are cut to shape from 55-in, wood

Next we have two flying bridges made from 28-gage sheet brasa cut to the shape shown in details 26 and 29. The edges are turned up and soldered at the comers to form weather acreens. The wing extensions

THE UPPER DECK AND FIDDLEY Friden Pan view of the parts which, in a woking model cover the deck opening shown below

> of 29, however, have stanchions instead of screen, as shown. For these the deck is bored and the stanchions put in, the ends being cut off short and fixed with a touch of solder underneath. The edge of the screen should have holes, and in the corner of the house there should be staples to which some No. 33 wire is fastened and rove through the two-ball, 1/4 in.

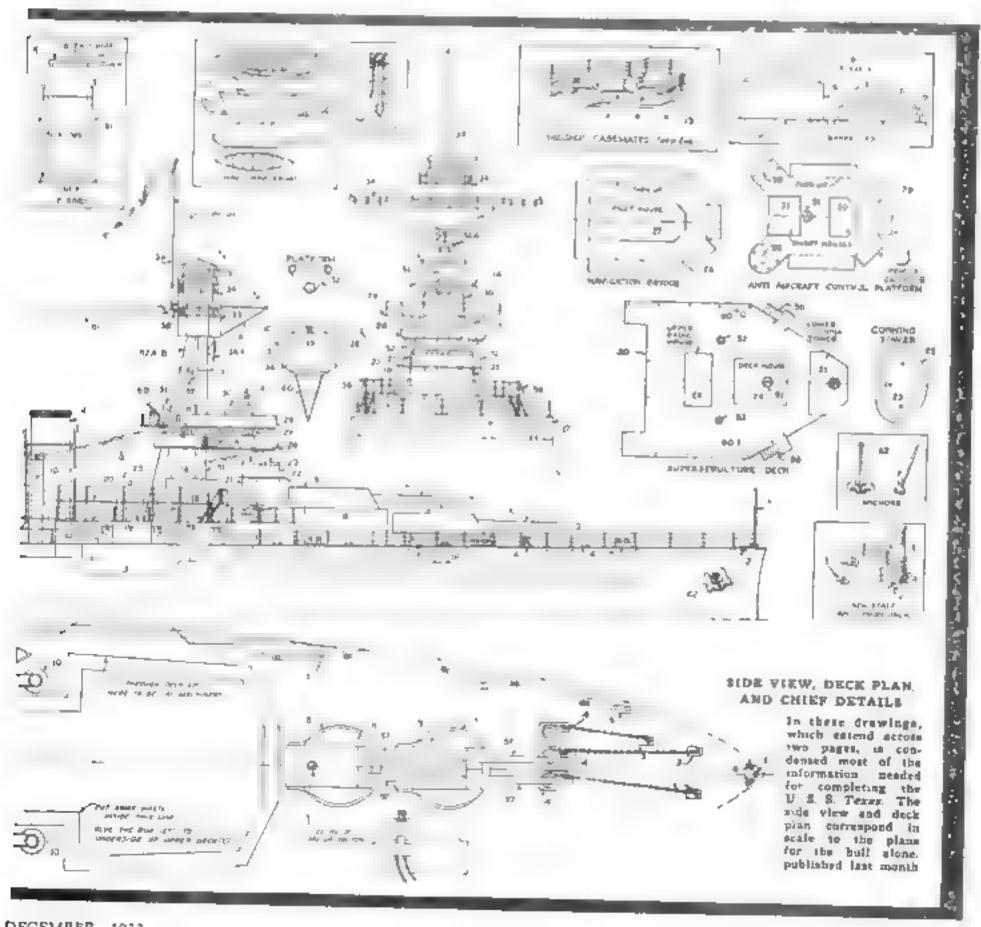
stanchions. Around the front part, the screen is peculiarly shaped to form a wind shield, this can be indicated by fastening on carved plastic material or wood.

On the lower of these decks there is one bouse (27) and on the upper two (30, 31), and on 30 agam is a range finder, the construction of which will be found in detail 14

Each of these decks and houses (27, 24, and 18) needs a 14-in. bole through which the vertical part of the tripod (31) will pass, and the three decks require 3/16in, holes for the after struta (52).

These must be carefully bared. The tripod may now be erected. The best way to fix the legs at the top is to cut a piece to the shape of the main battery control station (33) about 1/4 in thick and nail this onto them. Reduce the depth of 33 by a like amount and glue it on

The description of the dock fittings will be continued in the next issue



For the man who likes to make unusual Christmas Gifts

Bridge Set Holder

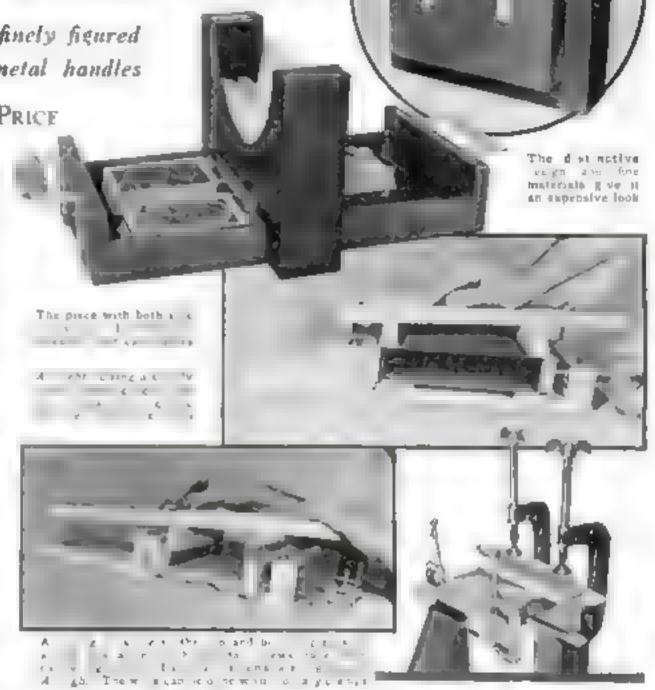
It is constructed of two finely figured woods and has bright metal handles

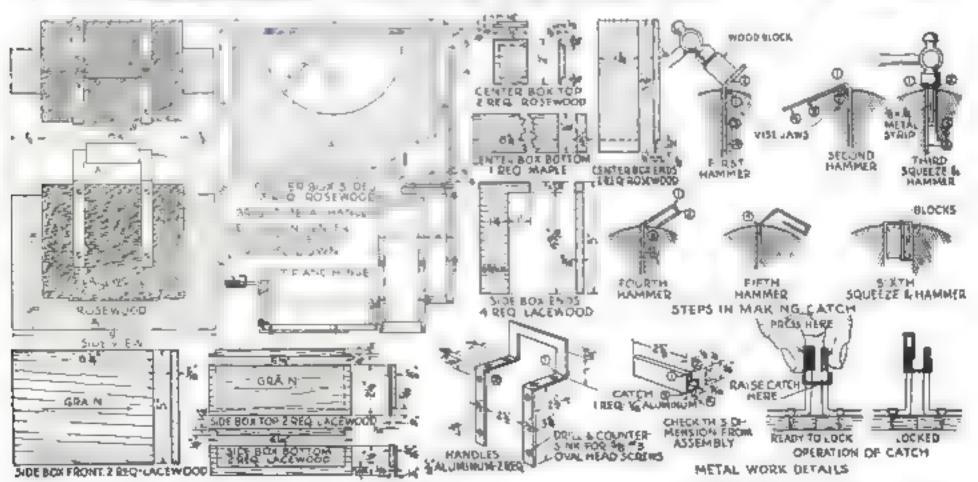
By DONALD A. PRICE

ELICATELY patterned, amber colored lacewood against a background of somber-haed rosewood and gleaming metal handles—this is the combination of materials that gives distinction to the bridge set holder illustrated. It is no attractive and practical case for keeping handy the cards, score pads, and pencils required for four tables of bridge. As a Christmas gift, it has obvious advantages; and while it looks expensive, the cost is low, especially if several of the holders are made at once and he price of he small amount of necessary materials is divided among them.

The work resolves itself into making bree boxes, fitting them together, forming be metal bandles and catch, and finishing the wood in an appropriate manner

In preparing the parts of the boxes, especial care should be taken to get them square and accurately cut to the dimensions shown on the drawings. The cutting out and rabbeting can be done entirely on a small circular saw if available. To insure uniformity, trim the parts that fit together at one setting of the saw. For example, the tops froats, and bottoms of both side boxes should all be cut to length at one time. The rabbets on these parts may be made (Continued on once 90)



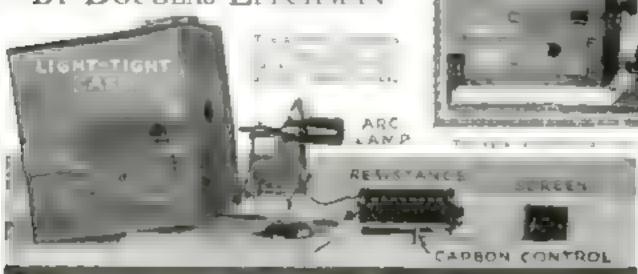


Top, sade, and sectional views of the assembled case, details of all parts, and shetches showing steps in bending and operating the catch

Homemade Ultra-Violet Lamp

With it you can perform unusual tests, do scientific sleuthing, and detect invisible erasures, stains, and sometimes forgeries

By Douglas Leichnan



LACK light," most amazing of many recent and tome to the equipment of the scientific detective, is easily produced in your own home with an expenditure of but little time and very few doc-ALC:

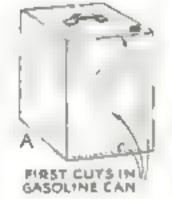
These rays, the vibrations of which are shorter than are those of ordinary light are called "black light because they are quite invisible, but if an object in piaced in their path fluorescent light, similar to the Light of luminous watch dials, is produced. Some materight glow with a dazzling blue, others a brilliant red or grange, and so on, almost every color being displayed by some chemical compound or other

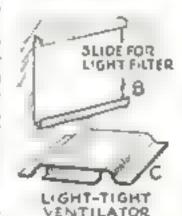
While the apparatus employed for producing these

rays, as used in large technical laboratories, is complicated and expensive, an efficient ultra-violet lamp may be rigged up in an hour or less, once the necessary materials are secured. The essential equipment is a carbon are lamp in a light-light box, a sintable resistance coil, and a glass acreen chat is opaque to visible light but transparent to the utra-violet rays

The carbon are and its resistance roil can be taken from an old lantem-slide projector. Discarded models are often to be had from electrical shops. The type required is one that will run on 110 volts. A. C., the ordinary house-lighting circuit.

In many cases projection ares were made in light-tight cases, complete with a window for insperting the arc and controls for the carbons. If you can get one of





these, so much the better. If not, it will be necessary to build a box to house your arc My own was made from a gasotine can measuring 10 by 10

by 14 m

Make a cut right down the middle of one of the long sides of the can and again at right angles to the first cut at the topand bottom, as shown in the drawings at A, Bend out the two flaps thus formed till they are in the same plane as their reighboring sides. When in use, this open side forms the bottom of the box, but it obviously will ant be light-tight until the space at each end is filled. To do this. cut two sheets of tip about 11 by \$1/2 in, and solder them into place, one at each end. Trim any rough edges with snips,

Make a baseboard about 12 by 16 in., center the box on the board, and tack strips of quar-

ter-round molding on all four sides, but do not fasten the box (or can) to the baseboard as it must be taken off occasionally to get at the art. The edges should

be light-tight all round.

Now for the various openings necessary The most important is that through which the ultra-violet rays are allowed to escape To cut this, first place the arc in position on the baseboard and measure the vertical distance from the board to the point where the carbons meet. Then, at the front of the box--originally the bottom of the can -mark a point at the same beight and equidistant from the two sides. This will be the center point of your opening, which should be cut to fit your screen or filter

My screen is 2 in. square, but it happens that my are lamp has a circular bood

a tig from the front of it, so I cut round hole to far this and proup ed my in front on a tube. If a section maning is used, part of the waste I it may as to form grouves for the to slide in as shown at B, or brack ets may be soldered on to carry it.

A hole about 1/2 in in diameter should be cut in the side of the box in such a position as to make inspection of the arc easy. A slip of colored glass-mine is green-should cover this hole, and it may be held in place with grooves like those

holding the light filter

Uniess your arc has an automatic carbon feed, holes must be cut through which to pass the carbon controls. Their size and position depend entirely on the type of are used. In my own case a single round

hole was necessary

There must be a ventilator in the top. as an arc light develops a good deal of heat. Cut two sheets of tin, one shoul 2 by 4 in, and the other 4 by 5 in., and bend them to the shape shown at C. Solder these over an opening cut above the arc, fitting them anugly enough to be lighttight. Give the whole box a coat of dul-Inack, inside and out,

The arc lamp may be connected with the house circuit by an extension cord and plur after cutting in the resistance coil. It doesn't matter on which side of the circuit the coil goes, but it must be of the right capacity for the art you are using A switch somewhere near the baseboard is a convenience. Holes should be drilled through the baseboard for the wiring.

The glass screen may be obtained from several companies that make technical glassware and light filters. The screen I am using is double, that is, one in front of another, a total thickness of about 8 millimeters, and cost me two dollars, It is a very dark purple in color and quite black unless held up to a strong light

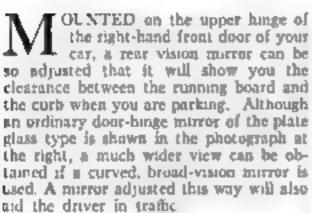
Ordinary carbons may be used in the are lamp, but the cored carbons specially made for the ultra-violet "health lamps" are better as they produce more of the wanted rava.

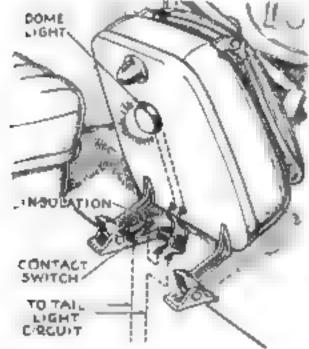
With this equipment set up in a darkened room, the (Continued on page 90)

Hints Useful to Motorists

Mirror Mounted on Front Door Gives Driver Helpful Rear View in Parking

> Drawing at left shows how mirror at mounted on front door lange to show curb Photo below gives view at seen from drawer a seen





Floor Light for Car

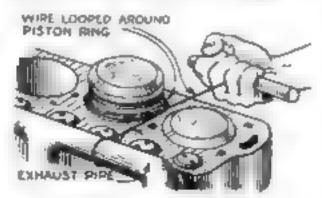
Tipping up the movable front seat on a two-door sedan wired according to the sketch shown above, automatically floods the floor and rear seat with light. The light, of the usual dome light type, is fitted into the underside of the seat and connected into the tail light circuit by means of two contacts, one on the seat and one on the floor. These are so arranged that they touch only when the seat is fully raised. Being connected into the lighting circuit, the device does not operate during the day when the other lights are not being used.

Fitting Piston Rings

AMATEUR mechanics, who have no special tools, can spring new piston rings into place by means of a loop of strong wire. The wire is anchored at one end to an exhaust pape and then looped around the ring to be compressed. A suit-



able wooden handle, fastened to the other end of the wire, provides a convenient grip for pulling the wire. The tightened loop compresses the ring so it will slide east v into the cylinder. By pushing the piston down, the loop can be placed over the next ring and the process repeated.



Wire fastened to enhant pipe and then looped around platon ring compresses it to fit cylinder



Filing Your Brakes

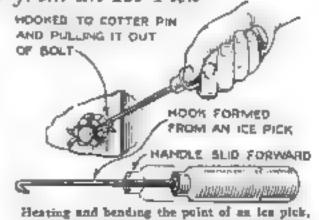
EXTERNAL brakes that have become scored and grooved through long use often can be put back into first class shape with a coarse file. Jack up one wheel and remove the brake bands. Then, with the gear shift lever in high and the motor running a trifle faster than ordinary ulling speed, apply the file (a twelve-inch fender file preferred) to the spinning drum in the manner shown in picture above Sandpaper and steel wool can be used for the finishing touches.

For Quick Starting

TWO DRY starting in cold weather can be obtained if two dry batteries connected DOUBLE in Berics are THROW SINGLE used to supplement the storage buttery. By means of a singlepale, double-throw switch the batteries can be connected in and cut out when the motor turns over

Making a Cotter Pin Puller from an Ice Pick

ALTERING an ice pick of the sliding-bandle variety, converts it into an efficient cotter pin puller. First, cut off about one inch of the pick and grind it to a blunt point. Then anneal the tip by heating it to a cherry red, bend the hook, and harden it by reheating and dipping it in water. In use the hook is placed in the eye of the cotter pin, the handle slid forward and then jerked back. When removing heavy cotter pins it may be necessary slightly to open the split ends so that they can be pulled out



Heating and bending the point of an ice pick, converts it into bandy tool to pull cotter pine

NEW ANTI-FREEZE GIVES

4-WAY PROTECTION



- Won't evaporate . . . fill now for the winter
- Leaks less than water
- **Stops** rusting and corrosion
- Positively will not clog or gum

PLUS lower price . . . more economical than ever

14 ADVANTAGES OF G. P. A.

- Gives complete protection against freezeups to 30° below zero.
- Will not evaporate not even on the warmest days. One filling lasts all winter.
- 3. Leaks less than water-
- Protects all metals of the cooling system against corrosion and the rust caused by tap water. This protection continues after G. P. A. is drained out.
- 5. Retards disintegration of rubber hose
- 6. Positively will not alog or gum radiator
- 7. Mixes quickly and permanently with water.
- 8. Never overheats motor.

- 9. Does not injure Duce or other finishes.
- 10. No unpleasant or dangerous futnes.
- 1), Safe non-poisonous, non-inflammable.
- 12 Permits better operating temperatures.
- Uniform in quality. Made to G. P. A. standards.
- 14. Lower in price. More economical than ever.
 - Why you can and should put G. P. A. in EARLY: Since G. P. A. will not evaporate you can easely put it in early. Thus you avoid the last trinute rush and all decept of early-season (reces-ups.)

RADIATOR GLYCERINE



GLYCERINE PRODUCERS' ASSOCIATION, 45 EAST 17th STREET, NEW YORK, N. Y.

Send your personal greetings this year with

CAMERA-MADE

Christmas Cards

Frederick D. Ryder, Jr., tells how to do it and gives hints on photographing children

CHN! You haven't done a thing about ordering those Christmas

My neighbor glanced sheepishly at me, and then at his wrie, who was busy with her Christmas list at the desk in

"You would bring that up." he grum-

filed, "Oh, well, let's just write our names on ordinary stock cards as usual "

"Why don't you make your own Christmas cards?" I ventured to suggest

"How, for instance?" he scoffed. "I'm no artist. Do you expect me to pual them ou, of my hat like a magician?"

You could do it with your camera," I explained. "It's a cinch to make cards that way and you get something really distinctive and personal -something your friends will appreciate a lot more than a highpriced engraved jub." "You mean to print

a picture on part of the card and letter in the greetings?" John questioned. "If that's it, nothing doing—takes too much time."

As I pointed out to John, it is perfectly

practical, with the aid of your camera and flashlight to duplicate the lettering photographically. An ordinary roll film camera and a photoflash bulb will do the trick. No special equipment is required.

Whether you do the lettering by hand or not, the first problem is to take the photograph that is to go on the card.

of a baby or of a group of young children. The face of a snuling child will add a cheerful note to the most formally phrased greeting card. Of course, in some cases a picture of a grown-up or even an interior "shot" of your living room may be more appropriate

There are any number of ways to pose

children. One that fits in with the Christmas nica, for example, is to have the child hanging a stocking to the man el over the

firejslace.

You can't make babies pose, You musi watch your chance to get the kind of picture you want. In any case all incoor pirtures of children can best be taken by flashlight. And that goes double streng h for bubles! It takes fast work even to keep an active and playful baby in front of the camera, so what chance have you to dictate the position of its arms or legs, or choose the facial ex-

pression it is desired to assume?

The photoflash bulb is especially valuable for taking pictures of babies because the quick, ellent flash of light does not seem to disturb them at all. I took four



Don't use one of last summer's snapshots or any other old picture your friends have already seen. A brand-new pacture will double the interest in your greeting. Perhaps the best bet is a good picture

\$100 in Cash for PHOTOGRAPHS of Children

Six cash awards amount of in \$100 are offered by Pur Lan School M. St., Y. for the best pictures of a chied or a group of children taken induors-pictures of a type suitable for making theistman cards as suggested by Mr. Ryder in the accompany of article

It is not necessary to submit a complete firestmas card all that is regu red is an unmounted print and the negative from which it was made as the contest will be adged on the photographic quality the naturalness, and the hurono interest appear of the picture

An the old drawbacks of taking pletures of ch laren in the house have been overcome by the introduction of photoflush bulbs, which make no noise dust

FORST AWARD	55()
SECOND AWARI	3.5
THIRD AWARD	(0)
AWARDS S.	SIV1H 1.5
101 (1	5,00

or smoke and involve no fire risk The contest a intended or mar ly to encourage you to ease to use this modern method of taking indoor photographs but day ght or any kind of t Institution or first ght may be used The developing and printing may be done by a professional but the picture must be taken by an emare r ouring the mouths of Suvember and Here nber 19.2 Mail both peror and negative t the Photograph a Lattor C pt sn nue New York not later than Janu art 1 ,933 and mark your entry December Places Concest." Also write on the back of the print whether daylight or artificial aght was used and it flaslight which type. You was enter seseral photos, but some will be returned This contest is open to all except emplayers of Promar Science Most A and their families. In case of ties each is of contestant will be awarded the prize tied for

How a letter brought NEW MAGIC TO JIM'S CAMERA

AM LST LOOK A THESE DAR, NO SHAP SHOTS WABEL TOOK OF HER BABY NO DE THE HE SE WHI CAIT NE TAKE MED MABEL SAYS TO EASY TO DO HERE READ HER LETTLR







A THESE NOOR SNAPSHE SALE BAS IF WED COLY KNEWS AS TOE MAZDA PHOTOF ASE LAMPS REFORE LEYS KEEP SOME HANDY ALL THE TIME NOW TO WELL BE READY WHEN THE CHILDREN PUSS





Take prize INDOOR pictures this easy way

TO SNAP Action scenes in the house, use G. F. MAZDA Photoglash lamps. These magic lamps enable ordinary box and fooding type cameras to get pictures of children, parties and pets, indoors—or of scenes outdoors at night... as easily as in sunlight.

For time exposures . . . portraits . . . interiors . . and posed groups, use G. E. MAZDA Photoflood lamps. They enable you to secure beautiful, clean-cut pictures with time exposures of 1 to 5 seconds. These new G. E. MAZDA Photoflood lamps are also the best lamps ever developed for home movie-making.

Ask your photo-supply dealer or druggest about

these two putare-taking lamps. Better still, get some lamps and try a few indoor pictures. That will convince you. General Electric Company, Nela Park, Cleveland, Ohio.

GENTEAL ELECTRIC Co., Ada Park, Cleveland, O. FREE: Please send me, free, a copy of "How to make Good pictures Indoors"

		P. B.M. In-1996
Name		
Address		
r.	Carte	



E MAZDA Plubfind lang

GENERAL ELECTRIC MAZDA PHOTOFLOOD LAMPS

photoflash pictures of a year-old haby one of which appears in the sample Chrimas card, and the little fellow didn to notice them at all, all hough a to roof them were touched off within a few feet of his nose.

One of the biggest difficulties in taking pictures of very young babies is in placing them where the camera can get them without encumbrances such as the fond pents' hands or arms. Another is in keeping the baby in the spot where it is in keeping

Here's a tip that will help

Place the infant in a large padded library chair. Focus with the baby head against the back of the chair. Then the mother can let go and get her arms out of the picture. At that instant this small bell or introduce some other similar diversion. If you are lucky, the baby will assume just the expression you want belote it starts to roll around or climb forward in the chair. If the bell doesn it its attention the first time you try it the mother can push the infant back to position again for another attemption.

Of course the camera would be fire supported in position with a triped, and

the room should be brightly aghten to minumize the effect of the flash.

Remember that the secret of success in taking baby pictures is almost unamited patience. Don't press the button on the photoflash lamp tid you get just the expression you want. If you shoot at the first half-way-right smirk the baby assumes, ten to one be'll hand you a beautiful smile just nfter the shutter çluses

After you have taken a suitable picture, the next job is to de-

sign an appropriate card. Do this roughly in pencil at first, keeping in mind the film size of your camera and the dimensions of the child's picture trimmed to the



e car lettering against a to this film should be printed to the lettering black.

photographicali
The solutio
letter a much lime
er card and theo
the crash lead
of your film with
the aid of a por-

a la Ricchi le

7

....

. .

Icait attachment focidentally, the execution of the lettering and decorations on the large card can be

relatively crude

First set up the camera exactly 3 for from any convenient vertical flat surface and mark off on the surface the corner limits visible in the finder. Cut a large sheet of plain white paper or white cardboard to this size

Consider this sheet as an enlarged Christmas card and figure out just where the picture is to appear and where you want the lettering. Do the lettering with black drawing ink, making the letters proportionately large and with coarse lines.

Photographing the enlarged card is simple. Place it on the marked place on the wall, see that the portrait attachment as in place on the lens and that the distance from lens to paper is exactly 3 ft. Make sure that the camera is in line with the center of the card and that the finder takes in all the corners. Then set the lens at stop 16, open the shutter, and touch off a photoflash lamp held about 2 ft above the camera as shown above.

Double-coated film, such as verichrome, is best for this work. If you develop the film yourself, increase the time of development about fifty percent

ment about fifty percent.
The finished film should show almost

This film should be printed on the hardest it most contrasty grade of paper so as to e the lettering black and the rest of the paper white

are o abor to a degree or

or a section cord with a pho day amp

T e a photograph as made

This gives you jet black let ering against clear while background but that is by be means the only possible com one ion, Numerous torang soft tons suitable for mateur use can be abla ned at any phora apply store. For example you could redevelop to sepia, which would give you sich brown lettering against a whi e background. The lettering could be made other we against white or you could tone the background peak or some other shaoe, teaving the lettering black. Etaporate comhinations, with the lettering toned to one color and the background dyed to a different contrasting or harmonious shade, are possible if you wish to go to the extra trouble apvolved

If you have figured out your design correctly, there will be a blank space on the print in which you can paste the small picture of the child, after you have trimmed the latter to the desired age. The result is a finished Christmas card such as is shown on page 78.

If you have a small camers, so small that the picture size is not big enough for a Christmas card, you can arrange a card that has all the lettering bunched together on one small area. Then you can print, or have your photofinisher print, your small negative of the lettering through an opening in a mask of black paper large enough to cover the whole of the card

size you want

It also is possible to combine the negative of the baby with the one containing the lettering and decorations by cementing them to proper sized openings in a black paper mask. Thus, of course, eliminates pasting the small print on the large one for each finished Christmas card. The combination negative does not, however, give such artistic results because the lettering portion will appear gray

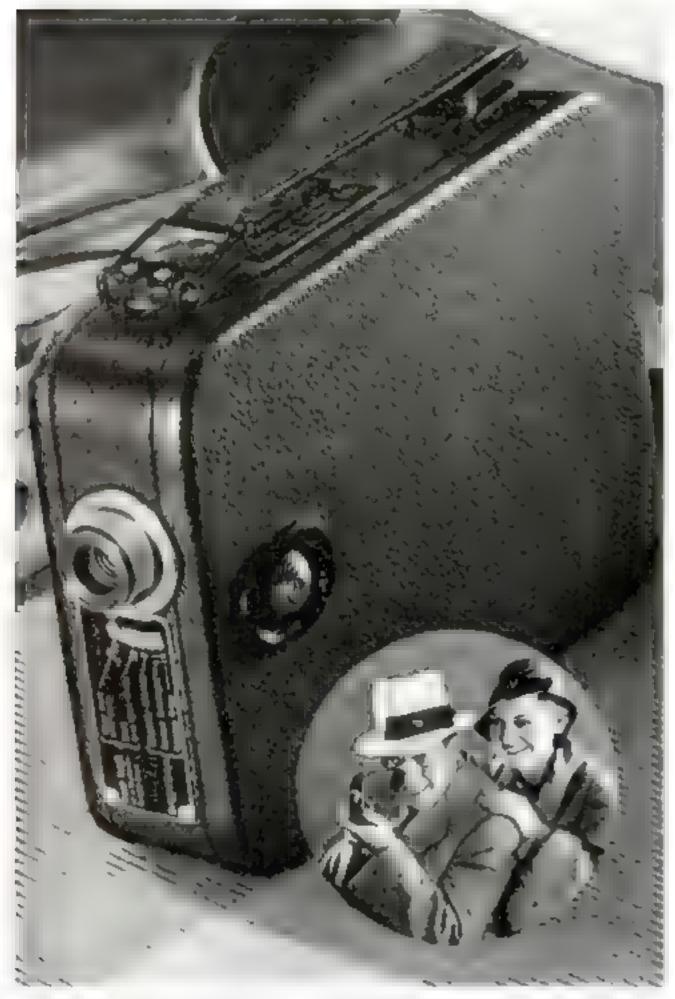
Photo Contest AWARDS

FOR the best photograph submitted in our August Photo Contest (P. B. M., Aug. '32, p. 92), Wilton Fisher, Telsa, Okia, has been awarded a prize of \$10. The following won honorable mention in the same contest: Harry A. Arnold, Jr., Miles City, Mont.; James Clarke, Honolola, Hawan, Frederick Gerding, Scheneotedy, N. Y; John R. Kennedy, Toronto, Canada, William Noertenhamser, Barnam, Win., Mrs. H. M. Pridham, Deytonia Beach, Fla., Fred W. Ruttger, Jameica, N. Y.; Joseph Schwarz, New York City, J. M. Stolan, Garfield N. J., Charles C. Tomney, New Brunswick, N. L.; Jack Warner, Beverly Hills, Calif., and Ruskin B. Warren, Bel Air, Md.

POPULAR SCIENCE MONTHLY

Eastman announces

a New Ciné-Kodak.\$29⁵⁰



Cond-Konat Biger is small, simple. A real full-fledged movie consers. Price only \$29.50.

using a NEW FILM that cuts movie costs

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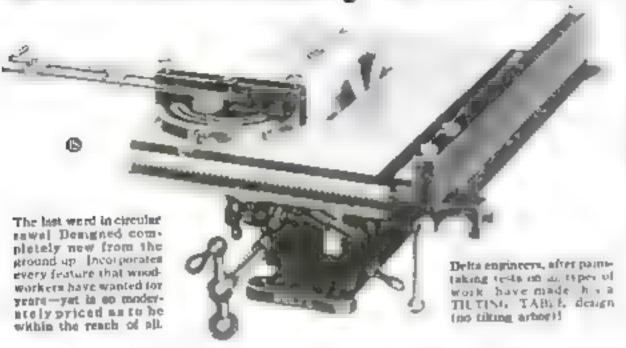
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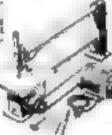
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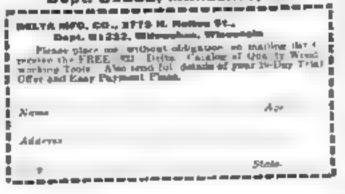
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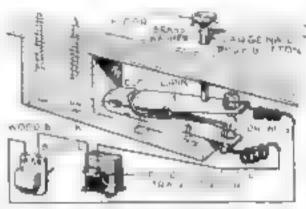
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A SERVICE ABLE floor push button tor an electric bell or buzzer may be made from an ordinary spring clothespin, a brock of wood a nad a washer and a tew wood and made screws. The accordinary ng ske chi s self-explana ary

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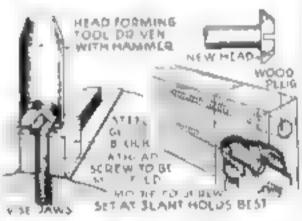


A nest and efficient floor push button made with the old of a spring clothespin and sail

pet or one cam because of wires runring and one to and the national be proved through he carpet white matetions of making it

or or dry cells may be installed close to the switch thus kee, on here out of eight and say in he cost of running extra wices.—F. W. HUTCHENSON

MODIFIED SCREW HEADS FOR SPECIAL JOINTS



is we flat acrew heads are mod.fied so that they will had bette in counterbared holes

ASSEMBILING whoowark with serens respectly when he seren heads are to be set into holes and cuscres with wood, age is as distinct adp age to modify the heads of the screws y using a cor like by shown A few he was with a himmer on the con will conar an ordinary the be discrew are a semi-roundhead series that is more surade for work of this kin. The head is made a trifle smaller for one thing but note important, he east sart t med down o term a type of show or which has no tendency to split the wood. It has not the wedging action of an ordinary screw head and seats itself more securely

A few screws treated in this way, if properly placed in a door that has pulled apart at the joints, will effect a permanent repair. When the acrews pass into end gram wood, as in this case, it is desirable to give them at a slight angle raber than straight.—Max Charles Price.

BENT TACKS GIVE WOOD SCREWS BETTER GRIP



IT 1S often difficult to make a wood screw stay permanently in place once the hole has become enlarged. A good way to do it, however, is to take three or more small tacks, bend them as shown above, and place them head down in the hole before replacing the screw. If the hole has become much too large, place tacks in it as before, then drive in a plan of wood and insert the screw. This method works well on loose door hinges and in repairing the bodies of trucks and other vehicles, Recently I used it to repair an electric iron handle.—I F, Goodman



F YOU have kept all the 1932 lanues of POPULAR SCIENCE MONTHLY as so many readers make a practice of doing, you own a gold mine of up-todate home workshop reference material-almost 400 pages relating to the shop and to craft work in all its phases, including practical suggestions in regard to automobiles, and up-to-theminute radio information, All you now need to make this great mass of valuable information immediately useful is a complete alphabetical index, so that you can find anything you want in an instant. An index for the twelve issues of 1932 has been prepared and will be sent to any reader for ten cents to cover the cost of printing and mailing

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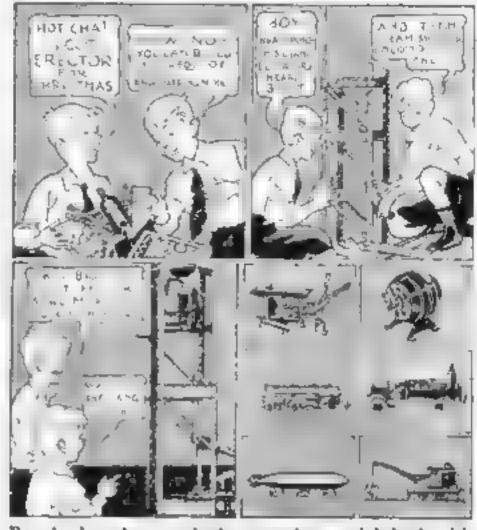
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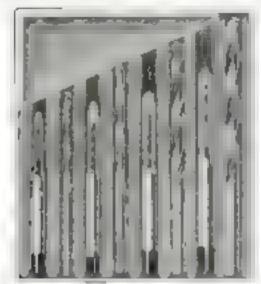
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THE long winter evenings ahead the enthusiastic canocist who aspires to make us much as possible of his own equipment, can spend many happy hours on the special equipment and accessories for the Publical Science Minimum to the Canada cover disavak described in three previous articles. It's Minimum sept. 32 p. 57 Oct. p. 70 and Nov. p. 80.)

The balanced log sail is well adapted to this cance. It combines maximum sail area with short, light spars which can be conveniently stowed below deck

The spars are made of straight grain sprace. A ferrule of brass is fitted to the foot of the mast and filed to slip into its tube amouthly just at the top of the mast tube a piece of rawhode or heavy leather is shrunk and gloed to the mast to take the wear of the jaw and to keep the mast from forcing down against the keel. At the bead the mast is hered in a fore-and-aft direction with a bele large enough to take the \$5.00, brassled halvard.

Round away the lower edges of this hole and serve the head of the mast to prevent splitting above and below the hole. The edge of the gram in the mast should he athwartship.

fiore small holes 1 in, from the end of each spar to take the chalk line

with which the sail is bent or fastened. Shape the jaw to fit the mast snugly but not tight enough to bind. Bore for the end of the boom first, and work out the jaw afterward. Give all spars at least three coats of spar variash and allow



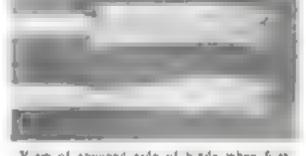
Spokeshaving a paddle blade. The handle of cit aquate until the brades are finished

A good grade of airplane cloth makes a fine sail, but there must be at least three thicknesses wherever grommets are to piece the sail, at head and foot, and along the lines for reef points. These points should also be double-stitched

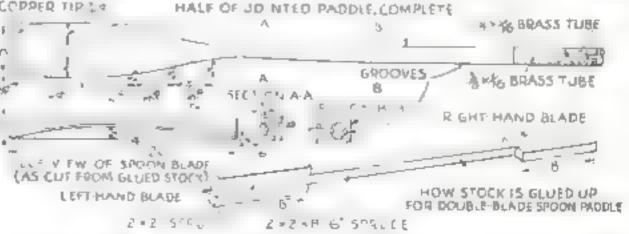
The leeboard-one is sufficient-can be

made of tedar or mahogany, but spruce is probably the best material because of its stiffness. It makes no difference on which side the board in carried, but usually it is to starboard. The edge grain of the board should point toward the bow of the cance when the board is in

position, and the side of the board should show the flat of the grain, so that it will bend without breaking like a bow. The greatest thickness of the board will be located about the end of the thwart with a stiffening center running down through



View of ensured side of bilde when hist-gladd and after being partly worked down



Smoon blade paddle with ininted handle. The perspective sketch shows the general method or graing the stock a though it is best to saw the pieces scrop shapes before graing them

the length of the board directly below the hole for the pin which holds the board to the thwart. The lower and after edges of the board are planed thin (1/2 in.), while the leading edge is tapered gently to 1/4 in, at the water line and rounded.

Maple, ash, or spruce are suitable for the leeboard thwart. It is important that the joints be tightly fitted, well glued, and carefully fastened with screws.

THE movable thwart should be of maple. It is fastened between the frames at any desired point in the cockpit by the use of small C-clamps. The back rest has two strips of maple nailed across the back at the right height to engage the edge of the thwart

The cuckpit tent, large enough for one canonist to sleep in it comfortably, requires 8 yd. of B-og. canvas. An army mosquito bar is easily adapted for honging inside to make the test insectproof A chalk line runs through the paired grommets in the lower edges and is looped around screws beneath the outwoie and drawn taut, holding the tent in place Sleeping in the canoe ashare will not damage the bottom if arrangements are made to prevent rolling and to assure a bearing the full length of the keel.

A double-blade paddle is needed to complete the outfit. The ideal type is 8 ft. 6 in long and has feathering, spoon-shaped blades. A piece of spruce 2 by 2 in. by 14 ft. 6 in, will be necessary. Plane the material square and mark the center line on al. four sines. Cut a 3-ft. section from each end from which to saw the two sidepieces for each blade. Lay the edge pat tern of the blade on one end of the long piece, adjusting carefully with reference to the center line. Mark and saw out Using the edge pattern again, mark the 3-ft, pieces. Saw the two pieces out and glue to the end of the long piece just cut, clamping firmly Treat the other end of the blade similarly, arranging the sidepieces to give 90-deg, between blades.

WHEN the glae is thoroughly dry, work the bades to the desired thinhese and crown, which runs down the center back. Work down the handle, noting that it is not round where it tapers into the blades, but oval, with the greatest dimension in ane with the thrust. If the blades are jointed, the ferrule will work hoose after a time unless extreme care is exercised in fitting

To lighten the handle, cut a rounded groove on each side of each half of the handle in a plane with the edges of the bladen. Make the groave 🌿 in, wide at the center, 7/16 in. deep, and tapering out to pathing 71/2 in, from the throat of the biades. Handgrips are left 6 in. each aide of the center, and the grooves between the grips are only 1/2 in, wide and 1/4 in, deep as there are four of them.

For cruising in stormy weather, a cockpit cover is a comfort. It is fastened to the same screws which hold the tent and in the same manner. A small triangular txece of brass fitting over the apex of the coaming holds in place the forward end of the cover and takes the wear off the material, as it is sown under the cloth.

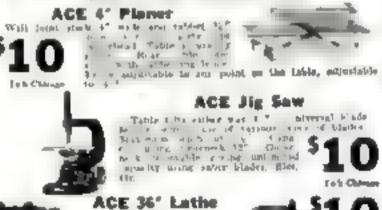
The collar of canvas surrounding the opening in which the paddler sits should







ACE Circular Saw Whith the an any one is expensed as the control of Heriman I office at the Martinoise of the Bod of the Tax while the the the threat the state of t La b Chiman





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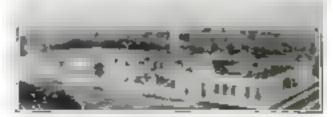
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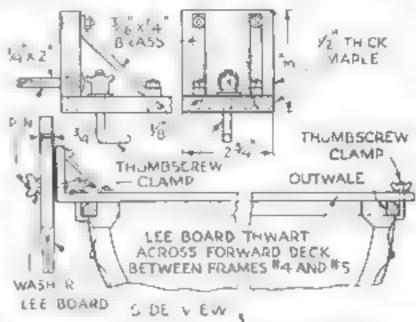
be at least 6 in, in beight and provided with a loose running draw string, which is drawn up but never tied. A very roomy, loose fitting, pull-over jacket of material similar to the cover is slipped on and the skirts of the jacket are dropped outside the collar. A string in the waist of the

jacket is drawn saug, and the paddler is ready for wet weather. Six-ounce duck is suitable for cover and jacket when thorough by waterproofed

One objection to the canvas covered cance is that it lacks flotation in case of an upset. In this cance, however, the cloth is so thoroughly inspired nated with dope that it cannot absorb much water. An additional safe guard is to shove a pair of small inner tubes into the ends on tap of what

ever dathe has been stowed there. When pumper up the tubes furnish extra flotation in case of upset and also wedge the dufte so that the compatishing

Here is a canoe and outfit in which a competent canoeist can go almost anywhere there is enough water, barring rapids, for which this canoe is too sharp ended. He will travel fast without undue expenditure of power, and a rainy day will not keep him asbore



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86

HOME EXPERIMENTS IN ELECTROCHEMISTRY

Continued from page 50.

become a conductor of electricity and is said to be sourced. The resulting solution is called an electrolyte and by means of a simple arrangement of apparatus we learned how to distinguish an electrolyte from a non-

In our last experiment with the salt solution we have made use of the process of concertion. Dissolving the salt in water causes the sodiam chieride to split up into minute electrically-charged particles or ions. The sodium particles carry a positive charge of electricity and the chlorine a negative charge These particles or lons are so small that they cannot be seen even by a powerful micruscope but they exist and play an important part in the process of electrolysis

By connecting the carbon rod to the positive terminal of the batteries, we give it a positive charge of electricity. Experiments with magneta have shown us that like poles or charges repel and unide attract. Similarly, since the carbon is positive, it attracts the negative chlorine particles or long and repels the positive particles of sodium. In a like manner, the negative copper strip attracts the positive particles of sodium and repels the negative chierine ions

BFING attracted to electrodes carrying a charge opposite to their own, the chlorine and socium particles or ions lose their charge. and become redium and chlorine. When each chlorine particle loses its charge, it becomes chlurine gas and appears on the surface of the carbon rod in the form of hubbles. Subam, however, is very active when brought in contact with water so that, as the sodium particle loses its charge by coming in contact with the copper strip, it reacts with the water to form hydrogen gas which is given off in bubbles on the surface of the copper

Rivo ng the tree of lead experiment de-scribed in a recent issue (P S.M., July 32 p 61 In the tin tree which can be grown in less than a minute by the action of electricity on a tip solution. Dissolve about a traspoon of the chloride (stannous chloride, in a haif glass of water and add several drops of bydrocharge said. Sufficient acid should be added to make the solution quite clear

Pour the solution into a U-shaped glass take mounted in the manner illustrated in the circle on page 61 and place a copper wire in one end of the tube and a carbon rod in the other. These electrodes are then connected to a set of two or three dry batteries connected in senes-the carbon being connected to the positive terminal and the copper to

the negative

I MMEDIATELY, becauteful crystals of tin-will form on the surface of the copper wire If the action is continued, a growth of two inches will be formed in about one minute.

The amateur who has no U tube suitable for his electrolysis experiments can make a suitable arrangement from two olive bottles as shown in Fig. 4. Remove the bottoms of the bottles and amouth any rough edges that may be formed. Fit a stopper into the mouth of each bottle and pass a short glass tube through a center hole in each stopper. A short. length of tubing forms the U-shaped bend

The solution to be used for the electrolysis is poured into the bottles and the rubber lubing is squeezed to remove any air hubbles. The electrodes are then placed in the solution through the open tops of each bottle.

In electrochemistry, dry batteries, a storage bottery, a battery charger, or any other source of direct current can be used. Because it flows in two directions, however, alternating current cannot be used where a definite reaction in one direction is desired.

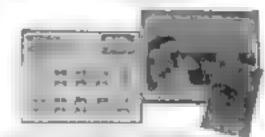
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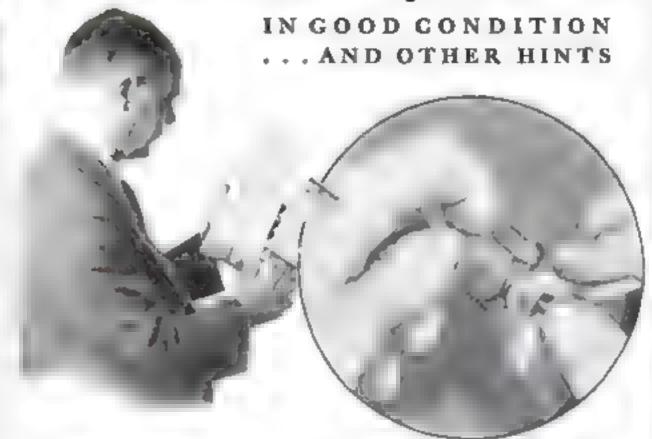
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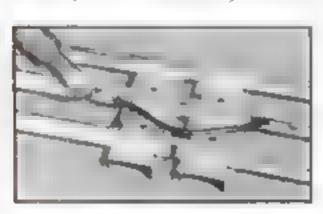
Model Railway Motors



Block for Gaging and Straightening Track

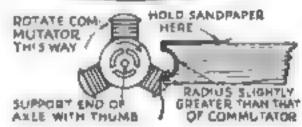
NO MATTER how careful you are occasionally a section of track gets stepped on. If the mils are badly bent, it will be simpler to substitute a new section, but when the damage is not serious it is easy to make repairs with a gage and straightener such as shown above. It consists of a I in thick board preferably hardwood, into which have been cut three grooves about 14 in. deep and corresponding in width and spacing to the three rails of the track.

If the rails are only slightly bent, you can start them into the grooves at one end and force them through. The better method is to use the board solely as a gage to guide in straightening the kinks



Bonding Third Rails

THIRD-RAIL connecting pins are supposed to fit tightly so as to give a good electrical contact. Occasionally they do not, and the resulting poor coolact causes the train to go slow at some point in the track circuit, Furthermore, these bad contacts may be found where they are inconvenient to fix, for example, in the middle of a long straight stretch that is already acrewed to the floor. The cure is a soldered bond as shown above



Truing Commutators with Sandpaper

WEAK spot in all model railway A motors is the commutator. When a train stalls or a locomotive loses its prp. chances are about ten to one that the commutator or the brushes are to blame

In theory the graphite brush is sup-posed to supply just the right amount of lubricant to keep the relied copper gause brush from culting the commutator surface. In practice, however dust one lubricating oil from the bearings form a gummy black deposit on the commutator surface, and the current no longer flows freely. Sparking increases, and the edges of the commutator segments start to burn

Frequent cleaning with gasoline keeps the trouble at a minimum, but eventually the commutator becomes so roughened that the brushes will not function as they should. When similar trouble occurs on n large motor, the practice is to place the whole armature in a lathe and turn a new surface on the commutator, but on a model railway motor the work can be done without a lathe, Cut a semicircular notch in the end of a small, flat piece of wood by drilling a hole and then sawing away the end. The hole should be slightly larger in diameter than the commutator, as indicated in the diagram above. Hold the commutator aguinst a paece of No. 00 or finer sandpaper in the notch, with the thumb on the end of the arle, while you rotate it with the other hand. Never use emery paper



ON ELABORATE model railway layouts, planned for the running of several locomotives at the same time, trouble is usually encountered with the rheostat control. The cure for this is to assemble a multiple rheostat such as that illustrated, and divide your layout into sections, each section being controlled by a separate one of the grouped rheostats

The heavy-duty 2-ohm rheostats sold for radio laboratory work are suitable. One of them will handle a standard gage double-motor locomotive without overheating. To remove the individual shall and substitute a long shalf is easy and a beavy aluminum or brass strip will "gang" one row of connections.

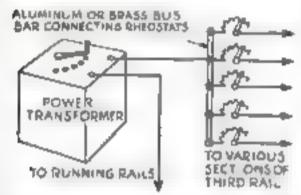
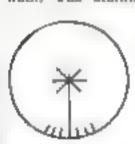


Diagram showing way to connect the multiple throatst to the various third-rail sections

Small Reflector Made Without Soldering



IT IS often desirable to supplement the room againg with additional overhead lights in out-of-the-way corners of the model railway track layout. Illustrated above is a light of this type made from an auto dash socket and a sheet of aluminum. The aluminum is out in a circle



After the a aminum disk has been cur. slits are made as In this diagram with cuts radiating from the center, and the small nicks pear the long radius cut. Slightly cone the circle by pulling the nicked edges till the nicks overlap. Bend the tabs thus formed in alternate directions. Now push the socket through the points.

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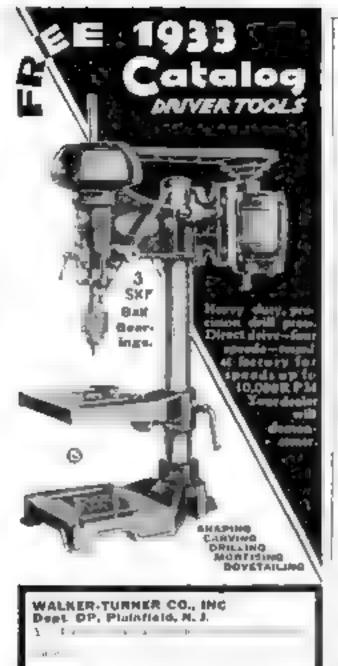
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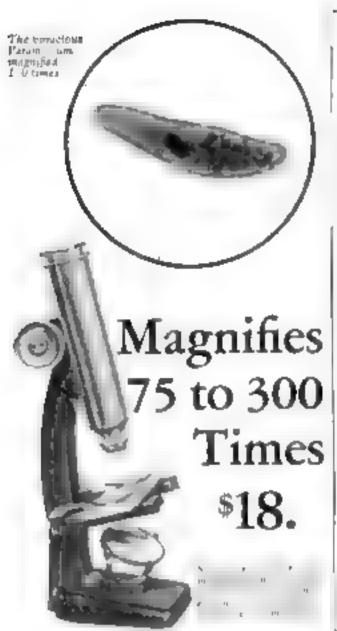
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WHAT YOU CAN DO WITH A MICROSCOPE

Contrared from page 33

mounted in handles. It will be found that old paint brush bandles (for water colors) may be cut off and used. These, too, are split and the ends of the needles bound in place. A little shellar applied to the thread will make it wear better. One of the needleis bent and to do this it will be necessary to beat it in an alcohol flame until it is red The needle will then bend easily. Afterward it should be re-heated and plunged into cold water to brine back its hardness. It will be I found that these needles will have to be dressed up from time to time on a fine pocket stone. They should be suped off with thin all each time they are used to prevent them from rusting between curuesions.

Num for the forceps. A cheap pair, the smaller the better, may be bought, it will be found that the cheap ones do not set perfectly and this makes a little Job for us in storing and tapering the ends down until they come together perfectly. A little patience will be needed until a more fit is procused. It should be borne in mond that the thinks handles are tiny almost beyond words and thes a rout of anything but the most conarmer any. The control should be treated with all cash time this ate and

MEDICINE of quart and more through A fit If another with a come spent are he consider in the better the time being the condition to buckup As a ma goes on a shift have the ton it makens more accessories but for the promint we most keep in mind the fact that we are cookies at the game and we cannot learn to do exervitions or rought

New let's my a word or two a seat he leases. It should be borne in mind that the metal parts of our interescopes amount to much junk if the optical side of the instru ment is destroyed through improper care The lenses must be kept clean and free from every trace of grease and list. A piece of line in our machine will look something lake the skricton of a twenty-five foot box con-

scratur under the lens To keep the lenses clean, we must not wash them in the ordinary sense of the term. Indeed if we take proper care, we need only gratly wipe them all with the soft tailed timue that may be bought in any five and ten cent store. Ordinary thous paper is far ion course and will scratch the comparatively soft and beautifully ground glass. If some readirt sticks to the lens, we may use a bit of grain alcohol and tesue to remove it. In short we treat our lenses to though they were worth their weight in gold. They should NEVER be touched with the fingers, If you could see the ends of your fingers noder & microscope you would need no other explanation as to why this is true

NOW for a pech. But wait, for we must proceed with a professional air. Other wise we shall be all fingers and thumbs and might possibly damage our equipment. First we look about the house for subjects. We don't have to look far for our very person has plenty. We mucht pluck a hear out of our head, or take a tiny flake of skin that bas dried. About the house we can find a bit of vinezar, salt crystals, or an old raror blade. However, as we shall discover later, things like old ramy blades do not transmit light and consequently we could only hope to see the shadow outline of such an article with light coming up from below

For convenience, let's thoose the hair. It you have not seen a burnan hair under the microscope, you will be amazed. Contrary to what you might expect, we do not take the bair in our (Continued on page 93)

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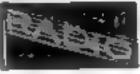


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WHAT YOU CAN DO WITH A MICROSCOPE

(Continued from page 92)

fingers and stick it under the objective of the microscope and then adjust the instrument so that we can see it. As a matter of fact, this procedure would be quite impossible. First, we could not bold the bair still enough and secondly we should be faced with the pecessity of holding it within an area measuring only a few thousands of an toch in dumeter Quite a chore for untrained hands !

With every microscope there comes a lew slip glasses. These are thin little strips of clear glass and it will be found that our microscope is provided with little flat springs arranged on the stage in such a manner that these little slips may be held by them. What we do then is to take two slip glasses and place the hair between them. The whole arrangement is then alipped in place on the stage. Take care NOT to finker the sup in the vicinity of the specimen for if we do we shall be surprised to find great smears of grease sweeping across our field of vision.

THE next step is most important because cause if we do not follow directions we shall run the risk of running part of our instrument. After the specimen is in place, we take the course adjustment acrew of the machine that controls the metal tube into which the objective and occular is placed and move it downward until the tip of the objective is about a quarter of an inch from the surface o the slide or slip glass. With higher powered machines, it is necessary to move the objective a little closer

As we do this, we note carefully the direction in which the controlling screw is moved to brong about this DOWNWARD movement of the objective. We must keep in mind the fact that when we focus we ALWAYS focus upward first and that this screw must be turned in the appointe direction. It should be beene in mind that as we focus we connot see the objective and that should we focus blindly downward the objective might be forced into codision with the glass slide and we might break the objective. That is the remots a good microscopust always focuses h s instrument upward.

The objective set in position, we now turn the light on and adjust it and the micros (mounted in a gembal) under the stage until a nice, even field of illumination, not too bright, is produced as we look into the eyepiece or occular

NOW we bring our eye to the eyeplect and set about making the focus. We must not press the eye against the eye piece and we must try to keep the other eye open. Working in a dark or darkened room will help asthough experience will teach that this in not necessary It will be pure chance if, in placing the hair specimen on the stage, we happened to bring it directly under the objective. Consequently as we peck into the eyepiece we shall have to manipulate the glass slide until the hair is brought under the objective.

We must remember that motion is magnified too and if we see what looks like a telegraph pole being swept away by a 100-mile an hour hurricane, we shall know that that is the hair. Also remember that objects move in the direction opposite to that in which they are manipulated. We shall discover all of these things in trying to bring what turns out to be a highly animated fair into our field

OF VISION. Once the hair is in place, we proceed to sharpen the focus, taking ture to turn the knurled adjusting screw very carefully as the image sharpens up. A little practice will greatly increase (Continued on Jage 94)



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MAKE LEAD SOLDIERS BY THE DOZEN!



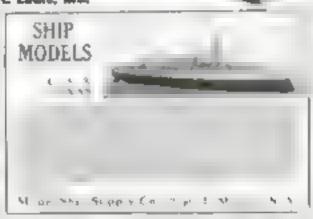
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WHAT YOU CAN DO WITH A MICROSCOPE

, a used from page 937

our enjoyment and as time goes on we shall not that we can manipulate our specimens so that we can bring any part of them under the of matrix

thoog practice in focusing ran be obtained with a loosely waven falling a handkerrbid might by it is praced over the stage (slip classes might be used but they are not absolutely necessary and the instrument is focused according to the directions just given if the fabric is not poiled that, it may be found that one side of it is in focus while the other side is out. Small distances and aregularities in surface cause that. Now we can say that the slip gluss would have prevented thus had the fabric been pressed between two

FTER we examine the great pieces of rope A that go to make up our handkerchiel, we may pass on to a piece of greased paper. Here we shall find many things about paper that we did not know. It looks like a matted banch of fuzz under a good instrument. We sha! also find that we will be able to pass enough light through a piece of times paper to study its structure. Indeed for our first lesson, we can find many things about the household that will transmit enough light to give us a squint at them. An onson skin makes a good subject. So does a piece of apple akin scraped thin. Some good ripe vinegar supplies a rather interesting take of D T's. The snakes in this innocent appearing liquid are plenty and large? In examining the vinegat, we use but a single glass and place a drop of the liquid on it.

In this first installment we can do little in re than take in the first principles of microscopy. We shall just be entering the partials of an unendingly new and fascinating world. There remains much to be seen, much to be done as we shall have decrever

In putting the microscope away let us be careful to see that no trace of moisture is left on it. It should always be returned to its case to prevent dust from settling on and possible damage by being knocked over

If MAV surprise you to know that some of the world's greatest microscopists started as amateurs and mastered the fascinating art by patient work in their komes. Next month, Borden Hall will guide you further along the exciting path that leads into the unseen world around you See Papeliak Scrivel Montilly for January, on sale December 1

OLD YELLOW GAS FLAME AGAIN PUT TO WORK

Lances except for illumination were the flickering yellow flames of the first gas jets. It was not until Robert Wilhelm von Bansen, tamous German chemist, discovered the secret of garant air with man to produce the blue flame that bears his name that gas became the servant of man for heating purposes as we as for highting homes and streets. Strangely enough, science and industry are now turning again to the flickering yellow flame which is remaining its lost prominence under a new guise known as the "diffusion flame" for certain industrial applications, as in open-hearth steel furnaces, according to a report issued by the American Gas Association.

The new "d flusion flame" in yellow, long and flat. It may be produced by rows of alternate air and gas slots in a special burner. Although its temperature is lower than that of a blue Bursen flame, tests show that it actually has a faster rate of heat transfer in many high-temperature operations, because of the increased proportion of energy emitted as radiant best. It also maintains more unform combustion in the furnace.

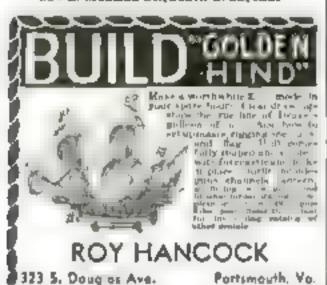


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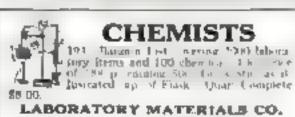




Tricks With Electricity

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SHOP CLAMP IMPROVISED FROM OLD BED RAIL

STRONG and useful workshop clamps can be made as shown from a length of angle from taken from an old bed frame Cut this into four equal lengths to make two pairs. Also prepare two long threaded rods, each with an eye bent at one end To assemble the clamps, drill a hole near

> EVE ON BOLT WASHER WING NUT

The elling size? clamp holds both biguate and ifregularly shaped work

one end of each of the pieces of angle from, place the eye of one of the threaded rods between two of the angles, and fasten loosely with a bolt or rivet. Do the same with the other pair Either wing nuts or ordinary nuts will serve for lightening the clamp, provided a large washer is used under them. This clamp is fully adjustable and bolds arregular shapes.—E. C. Boxx

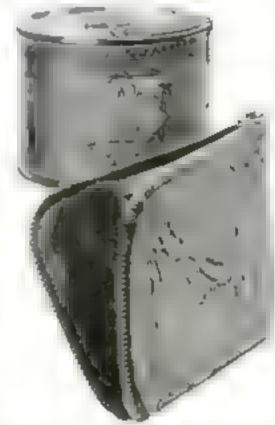
TEXTILES WATERPROOFED IN METALLIC SALTS

WHEN it is necessary to waterproof canvas or other textiles, the following method will be found to give especially satisfactory results: About 171/2 pounds of aluminum sulphate, blue vitriol, or stannous chloride, finely powdered, are placed in a large container. In another container about 10 ounces of olese steame or marganic acid or soap are mixed with 15 pints of alcohol, and the whole is gentby heated and starred until dissolved. Then this solution is poured on the fine powder in the other container, and the mixture is kept under constant stirring at a temperature of 104 deg. Fahrenheit until it forms a solid mass. To waterproof any cotton or linen textue, a mixture of I part of this mass by bulk to 100 parts of water is made, and the material is drawn through it. For waterproofing salk or woolen materials, the mixture should contain 200 parts of water to I part of the solid mixture. After the material has been drawn through the liquid, it should be spread out until

Wanted ... from Model Railway Fans

short articles, bints, and suggestions of interest to all those who have a miniature railroad system or intend to build one. Each item should be illustrated with one or two clear photos and, if necessary, a pencil sketch. The text should not exceed 200 words. Payment will be made upon acceptance for all available material.

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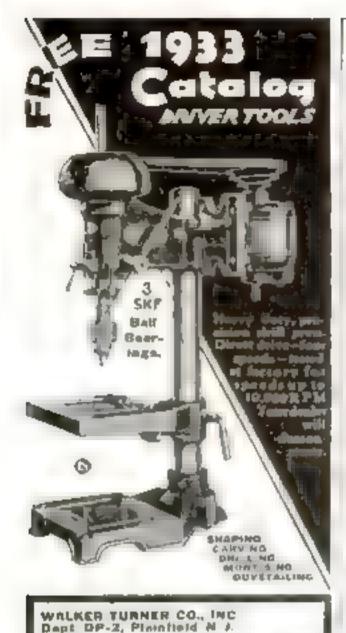
Ask any tobacco dealer for the Edgeworth Tobacco and Pouch Combination -the biggest \$1.00 bargain you ever saw for pipe smokers. It consists of a fourounce vacuum-packed tin of Edgeworth Ready-Rubbed Smoking Tobacco and a new Edgeworth Ready-Zip combination tobacco pouch. Also one dozen pipe clement. This pouch is made of strong, durable meterial, in a beautiful tobacco brown color, has a strong zip fastener and has a pocket for tobacco and a separate compartment for a pipe, Just fits a man's pocket and keeps his to bacco in good condition. The pouch was made to sell at \$1.50 and the tin of Edgeworth sells for 40 cents. The price of this 'Edgewort's Tobacco and Pouch Combination' is \$1.00. It is our way of interesting more pipe smokers in Edgeworth-\$1.90 value for \$1.00. If your men folks smoke, here is your chance to please them.

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"GET YOUR KEMKIT NOW-" KEMKIT CHEMICAL CORPORATION 126 Johnson St. Brooklyn, N. Y.



ULTRA-VIOLET LAMP FOR "BLACK LIGHT"

(Continued from page 75.

current may be turned on, the carbons adjusted, and you have "black fight"! There should be no light at all until some object is placed in the path of the invisible rays

There are thousands of substances which glow, or fluoresce, under the rays of the "black light" One of the best for testing your light and for demonstration is vaseline, which glows with an intense electric blue A solution of ordinary quitaine tablets (quining sulphate) in water also shows a fine blue. A piece of fluor spar glows as strongly as its name would suggest. Calcute also has a strong reaction and will continue to glow for a few seconds after it has been taken out of the path of the ultra-violet rays

Finger nails fluoresce, so do teeth fil natural), scars on the body, stains on clothene alterations in documents, and erasures on checks or other papers. Retouching of old paintings, repairs to rare postage stamps, and even forgeries can be detected.

It must be remembered that ordinary glass cuts off most of the ultra-violet, so if you are using an old lantern-slide projector all glacondensers and other such lenses must be taken out. Some substances will fluoresce under "black light" even if in ordinary glass containers, but better results are obtained if they are eather exposed directly to the rays. or held in quarte

Do out abow the ultra-violet light to shine directly in your eyes. If you work with the aght for more than a few minutes at a time a pair of goggles with amber glass should be worn

For a detailed explanat n il him "bia k light" is used by scientific detectors, re-cr to the article "Heard Lusern Rays Trup Master (rocks" in the this ther is it, is no of Post on Science Ministery page 35

COSTLY LOOKING BRIDGE SET HOLDER

(Continued from page 24

by setting the naw to cut exactly 1/4 in, deep with the fence set 5 16 in from the far edge of the saw cut. By successive cuts teem out the waste wood nutside of the fastial cut Any roughness left by the saw may be removed with chief or the

The use of casein glue is recommended in assembling the latter, as it allows paints or time for clamping up before it sets. For extra strength, mix it a little thicker than called for in the directions on the package

The clamping may be done with the usual clamps as shown in one of the photographs. but better results are possible if the glung ng illustrated is constructed. A flat board about 6 in, wide has an accurately squared block bolted to it at one end. Through this block extend three clamping acrews-in this case relies of cheap, broken C-clamps. Extra holes at different levels allow the application of pressure where desired. Nuts made from the threaded portions of the clamps are countersunk in the front face of the block Ordinary bolts threaded full length may also be used. A backstop is bolted to the base at the proper distance to take in the work and the necessary classifying blocks as shown. A series of holes in the base about I in apart allows complete adjustability. One bolt of each pair clamping the head and buckstop should be long enough so that it will extend upward through a 2 in, wide strip, and by means of these it is possible to exert downward pressure at each end of the work being gloed up. (Continued on page 97)

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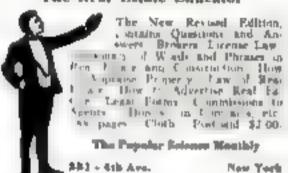
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For The Home Owner

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Details regarding the equipment best suited to the requirements of your home, will be found in this bulletin, copy of which may be procured by sending six cents in postage, to rover cost of mailing, to Popular Science Institute, 381 Fourth Avenue, New York City,

COSTLY LOOKING BRIDGE SET HOLDER

(Continued from sage 06)

The initial pluing operation on the side and center boxes is illustrated. After they have set overnight, the remaining sides should be given a final fitting, then the gluing may be completed with the aid of the same jig

Tom the glued joints with a block plane, and sandpaper the work thoroughly all over Set the light pone hinge entirely into the hottom piece of the side box and screw it to

the center box

Cut out the handles from aluminum or monel metal, and bend them as shown. The M-in material may be cut with either back saw or jlg saw. If with the latter, it will be necessary to slow down its speed to about

750 RPM

The briding may be done by hammering in a metal vise, using a block of hardwood to protect the soft metal from hammer marks Six steps in the forming of the ratch are sketched in the drawings. It will aid in obtaining a sharp, accurate bend if you mark the location of each bend on the maids with a light V-cut made with the cold chesel. After the catch has been completely formed and the corners squared up with a file, it will be necessary to open it up slightly in order to alip it in place over one of the handles.

Before finally putting the metal work in place it should all be gone over with a smooth life and sandpaper to bring it to a satis finish, free from deep scratches. This finish should

he protected with clear lacquer

If it is intended to have the metal work chromium plated, which would be describle although it would add to the cost, copper should be used instead of aluminum and the work brought to a high poush becore the

plating operation is attempted

The surface of the larg wood should be filled with unstained paste wond filer but the rosewood should be treated with filter that has been darkened with walnut stain, A scaling coat of thin sheller may then be applied and sanged down. After that a first rost of subbing varnish or lacquer should be put on and leveled down with fine sandpaper lightly appared. The final coat of varnish or lacquer should be subbed down with finely powdered pumice stone and oil, If a high polish is wanted, this may be obtained by further rubbing with rottenstone and oil.

LAPPING STRAIGHTEDGES

How to produce an accurate straightedge is well understood by machinists and toolmakers, but there are several points about the final lapping operation that are worth noting. If the lapping block is ground on a auriace grinder of the horizontal spindle type (using edge of wheel for grinding). It will grind a slight concave; If it is ground on a surface grinder of the vertical spindle type tusing the face of wheel for grinding), it will grind a slight convex. The former is due to the wearing of the ways, which should be scraped slightly convex by way of remedy and the latter is due to the slight tipping of the wheel in order to eliminate drug on the rear of the wheel. For a lapping block, the former is to be preferred because a concave apping block will produce a true plane on a straightedge. One can readily see that if the object is rotated by a sweeping motion, the ends of the straightedge receive more lapping than the center as they cover a greater area, consequently, this compensates for the sight concave in the lapping block

When lapping knife-edge strughtedges, they cannot be held very readily edge to edge for testing. This difficulty can be overcome by laying them on a piece of clear glass and holding them up to a strong light .- F.J W

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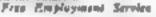
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HIS DESIRE TO KNOW "MADE" GUS WILSON

E'S NOT famous, but every reader of POPULAR SCIENCE MONTHLY knows him well You need no inreduction to Gus Wuson, Proprietor of The Model Garage. For many years he has been giving the readers of this magazine the benefit of his experience as an auto mechanic

What you don't know about Gue Wil-100 29 his history, the story of the steps he took from early manhood up the ladder of success. This little mography is a simple one, and its chief value to young men looking for a future lies in the fact that Gus Wilson is not a famous man, bot a great personality, or a public idol, He's on average citizen—just as we all are His one outstanding characteristic is his desire to learn, Although Gus knows his job from A to Z, he's smart enough to realize that he still doesn't know everything Consequently he finds himself learning something new every day and that's what keeps him up where he is.

Let's began at the beginning. Gus Wilson (we've given our word not to print his real name) literally grew up with the automotive industry. Whise Duryea tank ered with his first gasoline buggy, Gus Wilson, then a young man, was investigating and overhauling those ancient little steam cars that used to stop at every borse trough so that the driver, by means of a band pump and a length of bose, sucked gallors and gallons of water into the lank

When electric hansoms groaned their slow way over the streets of New York, Gus was giving first aid to batteries and sandpapering the commutators of many a motor. Somewhat later, the hage one cylinder engine of an old Northern runabout (remember that car2) lucked back on Gas and broke several wrist bones. His wrist is still a little stiff

SINCE then Gus has worked on almost every type of automobile ever made Every chance he got, every space bour he could spatch, was devoted to learning more about the queer kinks and odd points of an automobile. He studied to become a qualified mechanic, learned machine shop practice and automotive electricity. He wanted to know automobiles, know them so well that no car trouble would ever stump him -and he does

Over that long stretch, Gus had been saving steadily, and with a purpose. The day one of his busses decided to get out of the garage business, Gus stepped in and bought out his partnership. Today, his garage, located in New England, lives up to its name. It is a model of efficiency in service and of honesty in operation. Now, in addition to service and repair work, Gus has the sales (Continued on page 100)



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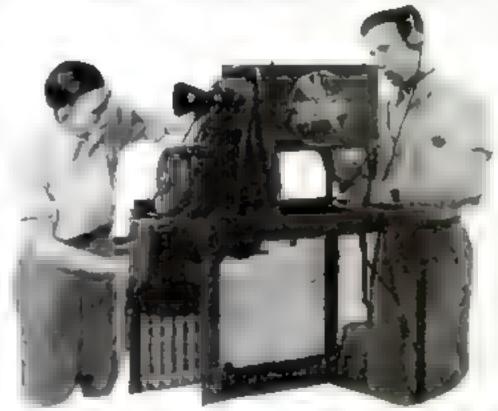
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(Centimed from page 48

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Gus Wilson started with the automobile. For young men who want to get ahead, there are similar fields of mechanical appeal that are now in their infancy. and that offer the same broad opportumties the borseless buggy did when Gus was a lad, Television, aviation, talking pictures, air conditioning need men of Gus Wilson's caliber. And there is always plenty of room for another good auto mechanic and radio service man.

THIS INVENTOR COULDN'T READ AT TWENTY-ONE

O'ER 2,000 practical patented inventions to his credit, but he couldn't read decently until be was twenty-one years old! That's just one interesting side light to the amasing career of Ethan I Dodds, next to Edison, the world a most prolific inventor,

All these patents have been taken out in the last twenty-five years, which is at the rate of one every four days or so Yet the man who conceived them couldn't read fluently until be was twenty-one and was dismissed from a small college one week after entering. "I'm sorry, Dodds." the college president told him, "but we

can't do anything for you." The college president was probably right. His institution could not have improved upon nature, which had endowed Dudds with unusual inventive genus When he was a barefoot hery of seven, sent home from a affire red schoolhouse near New Gamee, Pennsyavania, because he could not searn his A II C's, young Ethan developed his first invention. He heard his mother complain as she rubbed her aching arms after abortously stirring apple butter with a big wooden ladle in a cupper kettle. So he hitched a muscellaneour assortment of belts and pulleys to bec rocking chair, and thereafter Mother Dodds made the smoothest apple butter without rising from her favorite chair or

even looking up from her knitting At seventeen, he left home and his father's small coal business, and went to work as a blacksmith in the Westinghouse works at Pittsburgh. Here there was no keeping his inventive mind under cover Noon he became George Westinghouse's right hand man, and when Marconi came to Westinghouse with his first models for wareless. Dodds was assigned to help him.

For all his inventive genius, Dodds found it necessary to study, to learn methanical and engineering principals; to eliminate (Continued on page 101)



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Secrets of Success

THIS INVENTOR COULDN'T READ AT TWENTY-ONE

(Cantone d from page 100)

usciess efforts and to strive always for the practical. He had the foresight to see that study of methods and of records would speed up his work and direct his ability into rapidly moving channels. He found that studying and research work, that belped broaden out his inventive work, paid good dividends

After leaving Westinghouse, he become associated with E. H. Harriman, the railroad magnate, who built a laboratory for him beside his own home at Central Valley, N. Y., so the inventor could be at his call any time. Dodds still lives there

WHEN you make a night trip in a Padman berth, thank Ethan Douds for the fact that you don't have to sit up. all night. He invented the all steel sleeping car. Incidentally, when you switch on the light in that berth, you are using another Dockis invention

Among his latest inventions are an emergency's miners' lamp which stores "cold light" for two and a had hours, and the portable, electrical circular handsow now generally used by most carpenters and cabinet makers. An idea of his versatility may be gained from one of his methods. of invenion. When a company finds that its products are going out of favor and they are faces, with making changes or going out of business. Houds is called in for consultation. He works over the equipment and much nerv in the plant and hen sets to work leven ing an entire vinew prodact that can be made with the old machiners 1

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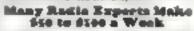
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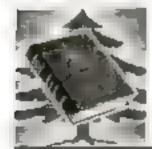
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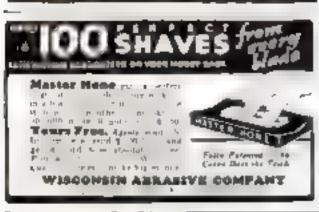
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SET UP A Sand Mold



Pouring a mold made from patterns seen in foreground, Compare with drawing D below

LUMINUM and other alloys of a low melting point are preferably the metals with which the model maker or experimenter should begin when learning to make small castings in the home workshop. The equipment for this work has been described in two previous articles (P S. M., Oct. '32, p. 93, and Nov. '32, p. 96),

After you have become accustomed to handling molten metals, a beat of bronze or brass may be taken. In melting these, poke a bole in the coal for the crucible. Wear leather gloves and blue glass goggles and keep a gangway clear between the fire and the mokt. In case of a burn, the foundryman's method of relief is to apply sweet oil, although linseed or lubricating oil will do if the other is not at hand. keep away from water or cold air, and after the oil application cover the burn with a poste of flour and water

With all the necessary equipment at hand, there are still several important things that the novice must bear in mind. First, the pattern, if irregularly shaped, must be examined so as to trace the joint line, or part-off, between top and bottom.

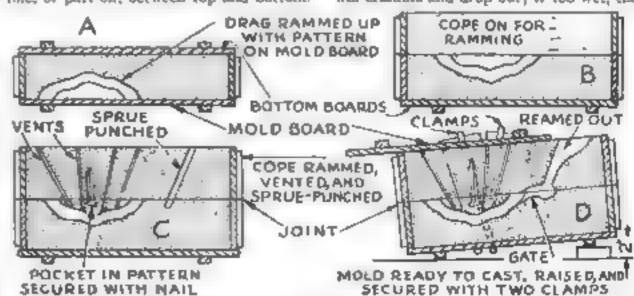
for casting metal at home BY JOSEPH C. GILBERT



Cautings as taken from the mold and as they look when assembled , lower right-hand corner)

For example, an anchor for a ship model would be sheed through the center to make two halves. One bull is beaded into the drag, the other protrudes above the joint into cope, which will lift off clean. In drawing the pattern out of the drag, if properly joinled, the impression of the pattern will be perfect and there will be no broken edges in the drag. With a little practice on flat or plain work, the beginner will quickly grasp the method of handling this work

Sand is another stem which cannot be slighted. It must be dampened to the proper consistency. If too dry, the mold will crimble and drop out; if too wet, the



Vigue phowing how a send mold is prepared. The drug is remined as at A and turned over, the cope is added as at B and rammed, and the mold is finished and set up as at C and D





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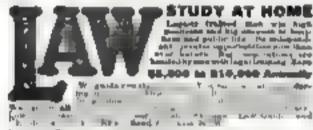
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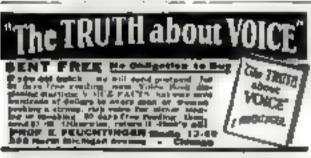


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sand will cause stacking on joint and puttern. A wet closed mold makes bad castings. When molten metals are poured into wet molds, steam is generated and may blow the metal violently out of the mold, which is exceedingly dangerous.

A GOOD rule for mixing sand is to add very little water at a time. Speead the sand on a piece of brown paper a yard square, sprinkle a little water all over it, and turn it over and over with both hands. rubbing dry into the wet between palms and fingers so that every gram may obtain its share of moisture. This done, gather it into a heap. To test it, grab a handful, squeeze hard, open the hand, and try to pick up the lump of sand from one hand with the other, or roll it from one to the other hand without breaking. This will indicate whether the sand is fit to mold If m squeezing it makes the hand so wet as to show a film of water, it is too wet To overcome this, add a little dry sand Keep a tomato can full of dry sand for such use. On the other hand, should the lump of sand cramble in picking it up. the mixture is too dry and would drop out of the cope

When the sand has been properly mused and placed in the bin, set the drag, joint | down, on the mold board and place the pattern in such a way as to leave ample room for the gate and surve at one end

as shown in the drawing at A

SIFT and over the pattern in the drag to cover as inch or two. Then fill up to about 2 in, above the top edge of the drag Start ramming around and near the sides with the peen end of the rammer l'een around and around from sides to center, adding more sand for a hard butting down. Strike off the surplus sand even and amnoth with the top edge of the drag Rub on the board and turn the drag over This is done by putting one hand under the mold board, the other on the upper board and with both hands pressing against one another, the mold is lifted and turned

With the removal of the mold board the joint should have a hard, smooth surface with the edges of the pattern clearly shown all around. Parting sand is dusted on the joint, then gently blown away from the surface of the pattern. The cope is put on as at B and rammed up the same as the drage then it is vented and the sprue punched as at C

The board is next rubbed on the cope, which is gently and evenly lifted off the drag and set on its side for rearring out the sprue hole. After this has been done, it is set aside until the pattern is gated to the sprue, swabbed and rapped, and drawn from the drag with great care so as not

to break the edges

Provided the mold in perfectly clean, the cope is again set on the drag with the board slid down until the edge clears the sprue by about 1/2 in. as at D. The whole is then clamped together firmly and set at an angle as shown. Push the wedges under the toes of the clamp with the bands only. Do no hammering of any kind as it may cause drop-outs. Closed molds must be bandled gently and carefully

The metal can now be poured as shown in one of the photographs. A stove poker is used to skim back the dross.



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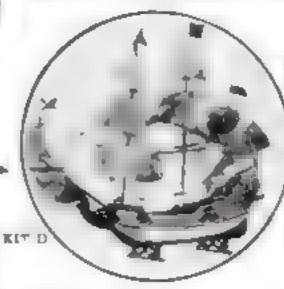
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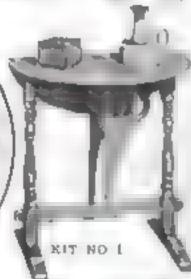
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BLAST OF GIANT ATOM CREATED UNIVERSE

Continued from page 29)

fine must much as droplets of water condense in a rain cloud. Although this theory, the well-known nebular hypothesis, has long since been abandoned so far as the origin of the earth and solar system is concerned, astronomers have been inclined to accept it in explaining the birth of stars,

One intuitively feels that the self building up of stars from cosmic dust is a process that would take an infinitely greater time to complete than the mere formation of planetary systems—a feeling that precise calculation confirms. If the expanding-universe conception is correct, we must revise our ideas about the birth of stars. Slow evolution is out of the question. A fireworks theory is exactly what we need!

DR LAMAITRE'S hypothesis does away with the old query as to the state of affairs before the beginning of things. Going back to the parent atom we may inquire about what happened before the cosmic explosion took place. The thiswer is, "Nothing." Computation shows that space would have closed up around the massive atom and, certainly nothing can happen where there is no room for it to happen. Time has no meaning in a perfectly statle world. The age of the universe is to be reckoned from that prehistoric Fourth of July, when space time into existence. Since then, space has been continually expanding before the oursisting stars sweeping the way for them, forming a sort of motorcycle squadron to make room for the star-procession to follow

Lemaltre's theory does not tell us how our earth was formed,—whether the planets were born at the time of the original explosion or whether they came into existence at some inter date. If his hypothesis is true, however, it is more attractive to believe the former speculative as it may be. At least this assumption will provide consolation for those who have immented the failure of the generally accepted theory to provide for more than a handful of possibly habitable workly.

SO MUCH for the present, What of the future? Einstein and the noted Dutch astronomer, Willem de Setter, have talked of some future contraction, which might sweep up the stars along with cosmic dust and eventually bring the world back to its original state. Dr Lemattre thinks that such a contraction cannot occur. He prefers to believe that the whole universe was born in the flash of a cosmic sky rocket and that it will keep expanding until the showering sparks which form the stars have hurned to clockers and ashes

SINK SHIPS IN OCEAN TO ATTRACT FISH

Sowing the bottom of the sea along the coast with sunken ships is a bovel plan for building up new fishing grounds advanced by Harry M. Armstrong, treasurer of the New Jersey Fish and Game Commission Wrecks always attract small marine vegetable and animal life, which in turn attracts fish By towing abandoned ships out to the three-mile limit and sinking them, Armstrong says, valuable new fishing grounds could be built up

SEVEN-FOOT FLOWER GROWN IN HOLLAND

One of the largest flowers that ever bloomed on earth opened recently at the Agricultural High School at Wageningen, Holland. It was an arum lify seven feet bigh and three and a half feet across. The blossom insted two days.

E

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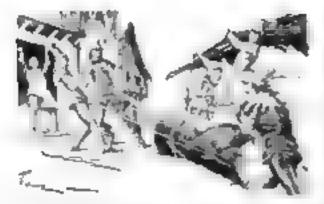
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NEW PLANT WIZARD RIVALS BURBANK

(Continued from page 45,

In his work with gladiolus, Henderson was aided in the task of tross-breeding is an uncount way. In his part of California, the Egyptian Moth, a nocturnal insect almost as large as a humming bird, is common. These moths are particularly fond of the nectar from gladiohis and flew from the common to the wild variety which he had planted side by side in his garden, carrying the fer-

tilizing pollen with them.

While he was stall at the Hurbank gardens, he had begun his experiments with this scentless flower, seeking to give it a delicate pertume. Hearing of a wild gladeolus in South Africa, called the "Gladiolus Tristus," which gave off a delightful fragrance at might, he sent for seeds. These he planted in his Fresno experiment garden beside rows of the common variety of the flower. By cross-pollenating. as well as by permitting the night moths to assist in the work of fertilization, he produced a new flower which, with each successive generation, possessed more and more tragrance a deughtiol scent like the aroma of gardenias and orange blowoms combined,

ANOTHER accomplishment to which Henderson "points with pride" is his Abundance sweetcorn It is a development from the Golden Bantam corn. The chief improvement in the new variety is the in-crease in the number of kernels. The Golden Bantam totally has only eight rows to the ear. By selecting seed from corn of this type which showed a tendency to more rows, and by repeating this process over a number of years, he has developed a new corn that has sixteen rows and a much longer ear. At the same time, the hernels have retained their

tenderness and high augur content

Someone has jocularly remarked that There is some good in everything, there being no bones in spinich," Henderson has produced another commendable quality, added attractiveness in color. By crossing Swim chard with sugar beets, he has developed a new variety of greens with brilliant red stalks and red veius in the leaves. This coloring remains even after the chard is cooked adding to the attractiveness of the dish on the table. At first, the result of the crossbreeding was plants of innumerable color combinations in leaves and stalks. But rigid selection over several years produced a type which comes true from seed.

BESTDES its unusual coloring, the new plant, known as the Crimion Guart chard, is a profuse grower with unusually large leaves. Three or four plants, Henderson calculates, will supply an average family with succulent greens for a season. Instead of going to seed in three or four months, as formerly happened, the new chard develops

reeds only once in two years.

Just before his death. Burbank was trying to produce a rose of unusual color and extreme fragrance combined with ability to stand heat and severe wrather changes Henderson's experiments with toses have been along these lines. He has a wild rose which he uses for hybridizing purposes, putting the varied colors of tame roses into the wild one Among the colors thus far produced are a dark, velvet red edged with black; adver pink, orange pure scarlet, and a yellow and broaze combination. Public taste in ruses, during recent years has run to vivid, brilliant haes, and Henderson has endeavored to satisfy the demand

Most of his experiments are carried on with a definate goal. Canners ask for a stronger Skip, a sweeter flavor or a larger size in a certain fruit. Henderson sets out to produce the desired improvements. Florists seek cer-

tash colors in certain flowers. Henderson works to supply them. But necessionally he makes an experiment without the alightest idea of what will result, "Just to see what comes of it." One test of this sort is going on now It is the umon of the pepper, the potato, the iomato, and a yellow plant similar to the jimsen weed, All four belong to the same lamily. But what the combination will produce no one can predict

In his work. Henderson imports new plants and trees from many lands. Austraga, Siteria bouth Area Japan, England, Turkestan and elsewhere from Airca, came a scarlet wistaria tree from Chile, a giant trumpet vine that blooms three times a year. from Siberia, ornamental crabtrees, and from

Japan, evergreen pears,

One of the strangest experiments he is carrying on is an effort to produce a peach with a pit flavored like an almond. Such a fruit nut combination was first considered by Surbank many years ago. He attempted to cross the stoneless plum, the peach, the nectarine, or smooth-skinned peach, and the almond. Ordinarily, the peach and the plum do not cross. Burbank obtained one such hybrid. but it was not a success. It never bloomed.

HENDERSON believes it might have been successful in a warmer climate such as Fresno's. Sudden dimetic changes often produce great differences is plants. The rhubarb, for Instance, grew only la seasons in its native country, Australia. In California, it became an evergreen, producing the year around. At his Presno farm, Henderson is grafting scions from stoneicas plums onto peach trees to reduce the size of the pit and the thickness of the peach-stone before going on to the next stage and crossing the peach and the almond. The final result, he hopes, will be a large and lustious smooth-sk-noed peach with an almond-flavored kernel,

SWIFT RIVERS OF AIR FLOW IN STRATOSPHERE

HORIZONTAL rivers of air, moving enputly in various directions through the stratosphere, were discovered by Prof. Auguste Piccard during his second ten-trale ascent above the earth in an air-tucht globe last August. The discovery, following prediction of such highaltitude currents, is announced in a recent report by Max Cosyn, Prof. Piccard's assistant on the speciacular balloon flight over Switzerland and Italy. Its importance is great to sponsors of high-speed planes designed for travel in the stratosphere, where a pilot could take advantage of the air streams to add to his speed. Another interesting observation during the latest Piccard flight was the absence of air pockets or eddies at the highest altitudes. At this writing, the data obtained resarding cosmic rays are still being checked and interpreted.

BONES OF RARE BEAST FOUND IN MONTANA

Exerting news to fossil-hunters was the recent abnouncement of Barnum Brown, dinomar expert of the American Museum of Natural History, of the outstanding discovery of the year by any expedition in this country The Montana Sod was a complete skeleton of a dinosaur known as "horbiosaurus." 2 creature so care that only a bandful of bony plates have kitherto tertified to his prehistoric existence. The newfound skeleton shows he was fourteen feet long, and seven feet wide, Heavy armor plates of bone covered him.

HOW ONE MAN BUILT A \$50,000 HOME

(Continued from page 47)

of oak that bear carved designs. These have been treated with crossole to preserve and color them. Over the windows are chestnut wood lintels, some of them partly-carved

Even the impressive corkscrew chimneys, one with two flues and the other with three. bear evidence of special treatment. The builder made the caps in his studio room, incorporating iron ore in the concrete. When this was exposed to the weather, the iron unidued, producing the desired aged effect. This little stunt is worth remembering by anyone who likes to produce unasual effects with concrete

A tadio sound expert visited Sommer one day, and remarked at the unusually perfect acoustics in the great studio room

Sommer plans to install a pipe organ in the studio some day, when other work is compicted. There is ample space for the organmechanism in an adjacent attic.

IN MAKING light fixtures, door knockers and other metal accentories himself, any home-builder could save numerous pennies But such fittings at the Sommer home had to be handmade. Mathine-produced lamps and hardware would be as much out of place in the atmosphere of Old England as a modernistic chair. So Sommer went to work at his basement force and anvil, From a runed mill nearby, he obtained an fron band that had kept the mill wheel shaft from splitting This he fush oned into a chandelier by adding candle holders and supporting chains. Other lighting fixtures, door knockers, binges, and catches claim the same origin.

The use of ordinary furniture would not be in keeping with the true spirit of the house So Sommer has made many of the pieces with his own hands. In the breakfast nook is a sturdy oak table, made in the true Okl English manner. There are beaches of the same period, theirs and other pieces. The collection is increasing stradily, for the farmiture is as much a part of the house as If it were built in, and must grow with it

Although the house has been in the progress of construction for four years, it by no means has been useless during that period. When only a heavy tanvas served as a roof for the breakfast nook and kitchen, Mr and Mrs. Sommer moved in. As the house grew, their hving quarters expanded until eventually they occupied the entire structure. This method, like many others smociated with the house, has its economical features

It is not likely that many persons can be found who would tackle so ambitious a project as building a house like the Sommer residence. But the method can be applied to anything from a cuttage to a custle.

I F THE house is to be right in proportion and plan, there is one economy that may not be recognized at first because it looks more like extravegance that is, the calling in of a competent architect, Although Sommer had planned his English house since he was sixteen years old-he is thirty-two now-he discovered that his final plans were not entirely correct. When he consulted an architect, he learned that his studio room was in the wrong place, and that several other details were not right from an architectural standpoint. These imperfections were corrected, and the result is a structure that is more pleasing in appearance and more easily lived in than if it had been constructed without the expert advice and aid of an architect

If a man can erect a \$30,000 house at a cost of only \$8,000, he has saved \$21,000 And if he takes four years at the task, he is actually earning more than \$5,000 a year because the old saying that "a penny saved is a penny carned still boids good.

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SHARPSHOOTING AT TARGETS FROM PLANES IN THE CLOUDS

Continued from page 42,

dives on each target. On gosty days, when for only a split-second the plane is steady the best across are made by firing short bursts of half a dozen bullets at a time

We are in position for another try Nichols peets down the sighting barrel, a long black tube, with bead and peep sights, pointing straight ahead on the cowling before his windsheld. By means of it, he aims his ship at the target. The machine-gun, at the right side of the cowling, shoots slightly to the left so the line of fire and line of sight converge 200 yards ahead of the plane.

On every dive, Nichols peers along the barrel with one eye partly closed but never entirely shut. The reason is simple. As soon as you close one eye, you lose accurate depth perception. You are unable to judge your exact beight above the earth. What may happen when this rule is violated is illustrated by the experience of one pilot at Aberdeen only a few months ago

HE WAS diving in a Falcon on a bumpy day. In his struggle to keep the bead on the bulkeye as he came in, he closed one eye. Before he knew what had happened, the ship crashed with a report like a cannon abot. He had flown into the ground at eighty miles an hour. Fragments of shattered Wings strewed the ground for a bundred feet and the engage, twisting from the fuselage, rolled she a tumbleweed ahead of the plane. Yet, by one of those miracles that sometimes come to the aid of airmen, neither the pilot nor observer was kalled

On our second dive. Nichula gets in a volley of a dozen shots, and a tracer bullet ricocheta twenty feet into the air like a flery red rocket. Every fifth bullet is a phosphorusfilled tracer. One of them, a few weeks ago, gianced from a rock filty feet in the air, passing between the wings of the gooming ship at the top of its arc. Another time, three ricocheted at once, like red sparks from an anvil, and the pilot had to twist like a

corkscrew to avoid them

In dry weather, tracers sometimes start grant fires around the largets. Then, the ground grew has to dip over the panels to black and make a dash to stamp out the blaze. One tracer-fire of this kind recently produced the price hard luck story of the field. A pilot was sure he had riddled the bulkeye and run up a record score. Then, his last tracer started a gram fire and threefourths of the target burned up before the ground crew could save and score #1

SEVEN times we dive on target number one. Then, the fifty bullets allowed for it are gone and we begin on number two. Each target has to be approached in a different manner On number one, you dive straight across the two lines. On number two, you make a righthand turn and on number three a left-hand turn inside the 1,000-foot line and head for the mark. On number four, you approach from the rear of the target, make a sharp half-circle inside the 1000-foot line, firing as

you head back.

Our first belt of ammunition is nearing the end. We wheel, dive, fire,-wheel, dive, fire. It is like riding a great roller-coaster, only a hundred times more thrilling. On each rarcle, our shadow races abread over the woods and creeks as we swing away from the min, then slinks back to fall behind as we turn about, facing it again. On the Pacific coast, "shadow planes" are used for targets in ma-chine gun practice. The pilots fly out over the ocean and the numbers try to hit the shadow, spinshes in the water showing where the bullets strike.

A deserted stretch of ocean is also usually the scene of the spectatular "towed target" practice. The Fifth Observation Squadron, when it is stationed at its base, Mitchel Field, L. L. heads out over the Atantic of Point Lookout for the work. The target is a light cloth "sleeve" or "sock," about twenty feet long, suggesting an airport windcone. A black band around the middle forms the bullseye,

While a towing plane pulls it through the air at the end of a long steel cable, the attacking ship, diving or sooming toward the sleeve, tries to riddle it with bullets. The attacks are made in two ways, diving from the rear or zooming up under the target from the front. In the latter method, the sleeve is going a hundred miles an hour in one direction while the attacking plane is traveling nearly as fast in the other. Consequently, the cloth mack streaks past the gunsights so fast only a crack shot can hit the bullseys.

FTER towed target practice, the sleeve is A dropped to the ground at the airport and the cable recied in. A special weight that runs out on the cable trips a catch dropping the sleeve. Not long ago, three sleeves were dropped one after the other at Machel Field and every one landed on the roof of the

highest hangar!

A pair of powerful wire clippers is always carried in the towing ship so the observer can cut the cable in an emergency. Sometimes, the weight which releases the target gets caught at the end of the cable. At other times, bullets cut the cords that hold one side of the cone's mouth to the cable and the sleeve starts to spin, whirling like a kite that has too short a tail Over Point Lookout, Mitchel Field priors had two siceve spins in a single week ferent v

In counting up the towed target score, the number of holes in the cloth is divided by two to determine the hits because a bullet passes through both sides of the cone. Sometimes a gunner is unlucky enough to shoot through the side at an angle that curries the lead out the open mouth. Then, he gets only

half-credit for his bit.

ON OUR final attack on target number two, Nichola gets in three short volleys before we flash across the 400-line. With our cartridge container empty, we head low over the observation tower, the ship rocking from ude to side as we waggle the wings as a signal we are going house.

Hollidge is making his last dive and the ground crew is climbing into a truck to go out and chalk up the score. Around every bullet-hole they will put a pencil mark and make a record of its position. A bullseye counts five, an inner ring four, and an outer ring three. Instead of pasting a whole new larget on the framework every time, they stick patches over the holes so the papers can be used again until they are riddled.

Halfway home, Hollidge creeps up on the left and the spine-tingling formation flying begins again. We come in over the bay in a steep sideslip and taxi to the starting line. Mechanics are waiting with fresh ammunition. We stretch ourselves while they reload the Browning. Red half-circles under our eyes, left by the goggles, give to an owi-like appearance. In five minutes, we are off again.

This time we work on targets three and four. Diving low over the treetops out of a sharp left turn, we blaze away for almost fifty rounds on number three. The air is fifty rounds on number three. smoothing out. Ground gusts are dying down. Shooting has become easier and the high staccate of the gun continues for longer periods at each dive. (Continued on page 209)



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Replember, No. 6050. New York County Clerk's No. 114, Rec.

No. 4674. (Real My Commission replies March 20, 202),

SHARPSHOOTING AT TAR-GETS FROM THE CLOUDS

(Continued from page 105)

Vichols swoops for a final fusillade on the third rectangle and presses the trigger. Nothing happens. He jerks back and forth on the charging handle and comes around again. Still the gun is silent. Nichols pumps the handle half a dozen times. We rirde for a third attempt. This time the balky gun goes into action like a triphammer, and puffs of dust shoot up behind the target to be stattered an instant later by the blast of our supstream as we burtle by

An old cartridge with a swelled case had stuck in the gun. Usually, a pilot can clear such a "stoppage" by means of the charging handle. If, however, the mechanism of the gun becomes "jammed," he has to land and turn it over to the armament expert. Neither accident as considered scrious. It is a runaway machine gun that brings the hair-raising emergency that every army pilot dreads. Such a weapon runs amuck, pouring out a stream of deadly lead that can't be stopped until the last cartralge is gone

A WORN firing pin, a broken sear, or a loosened plunger nut, Sergeant Lester Light, the armament expert of the squadron explained to me, will keep feeding live rounds into the chamber and make the mechanism run away once the trigger has been pressed Every day, after every firing, the guns are carefully inspected to prevent such accidents.

We have swung over to target number four The most spectacular phase of the work begins. Racing toward the rectangle from the rear, we zoom into a bigh wingover between the white lines and come back, tail high and nose down, ripping lead and streaking tracer bulicts through the mark.

In and out of shellbale pools, the reflection of our yellow wines dickers as we rush past Half a dozen times, we rare from back of the targets and zoom upward. Now we are coming in so low the landing wheels seem to rake the lop of the target as we roar by Nichols has got the range and is pouring lead in short bursts into the bullseve

Then the gun stops working. Peering through round openings in the metal cartridge container, I see it is empty. The last shot has been fired. He alge has already headed for home as our ship rocks from side to side and passes the lower

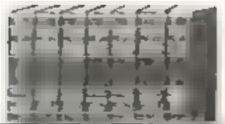
At the home field, we climb stiffly out of the marhine and unbuckle our parachutes. Wr are partially deaf from the thunder of the engine and pur cheeks are stiff from the rush of ward. In the pilots' room, Capt Barmon is at the telephone getting the record from the observers' headquarters. A placard, posted on the wall behind him, is labeled "Qualifying Scores."

IT LISTS the marks required for the three ratings. Out of the possible 1,000 points, a score of 438 gives a pilot the rating of Aerial Marksman, 615 Aerial Sharpshooter, and 788 Expert Aerul Gunner, Special insignia for the uniform and added pay are the rewards for crack shots in the air corns Harmon is jotting down figures and talking

into the 'phone, "Lieut, Nichola' score, outer circles, seventy six points, 228 , anner circues fifty five , points. balbeves, sixty-nine 2.70. right. score for the potats, 345. . . . right. day, 793 points . . right !"

The other pilots crowd around with goodnatured hanter Nichols has made the "hut score" of the day, five points above the qualifying mark for the highest rating. At the end of the month's training, scores will he averaged to give the final rating.

"And to be high man," Harmon tells him. "all you need is a few more gusty days"



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ANTI-FREEZE PROBLEM IS SOLVED BY EXPLOSION AND FIRE

(Continued from page 64)

of the radiator and the heat in the water can't get through to be absorbed by the air You ought to clean it out at least twice a year Especially before you dope your cooling system for the winter

"It's easy. All you have to do is buy a prepared radiator cleaner, dissolve it in the right amount of water, put it in the radiator, and then drive the car for about two bundred miles. When you drain it out all the dirt and shidge come with it."

"By the way, Gus." Gordon said, lifting the hood and pointing to the water pump. "My pump uses an awful lot of grease. Where does it all go?"

"RIGHT into your radiator," was the re-ply, "And it's the best little scale former there is. Half the dirt in your cooling system probably has come from the grease you've forced by the bearings on that pump. The natwer is to use a waterproof grease and use it sparingly

"But getting back to anti-freeze mixtures, why use alcohol?" Gus asked. "That went out of date with kerosene lamos."

"What's the matter with alcohol?" asked Gordon, "It does the job and it's chraper than anything che."

"It's not so though when you stop to con-sider it," Gus insisted. "Alcohol boils at about one hundred and seventy degrees, so If you run your motor at the right temperature you have to keep strengthening the malure.

With a solution of glycerin or ethylene glycol there's nothing to worry about as far as boiling is concerned. They may cost more for the first filling, but unless you've got a leaky radiator, the same solution is good for several years."

"Yes, and if your cooling system hapmens to have a small leak that you don't house about, you sprinkle the road with dollar bills," Gordon objected

"Well, that shouldn't be any drawback." grunted Gus. "It's no job at all to find leaks and fix 'em. One thing lots of people don't realize, though, is that solutions expand when they're heated. If you use an expensive anti-freeze, don't fill the radiator right up to the top of the overflow pipe but leave a little room for expansion.

The advantage of glycerine or ethylene glycol," continued Gus, "Is that you can run your motor Just as bot in winter as you do in summer without fear of having your antifreeze evaporate."

"How would I make up a glycerin solu-Hon?" Gordon asked. "Do I have to buy a special hydrometer as I did for the alcohol?"

N OPE. Glycerine makes the water heav-ier so you can use your battery bydrometer. To make a solution that it be safe down to zero, add enough glycerine to water to make the hydrometer finat level with the eleven hundred mark," said Gus, Indicating the mark on a hydrometer be picked up from the repair beach, "That'll be about a forty percent solution. A thirty percent solution will be safe down to about ten degrees, and the hydrometer reading for that proportion is one thousand and eighty "

"That sounds easy," Gordon commented. "Then if I want to test it at any time, all I've got to do is use the hydrometer"

"Right. But you want to make sure the solution is somewhere near room tempera-ture," Gus reminded him, "Thosa readings only hold at sixty degrees"

"You win, Gus," Gordon finally agreed.
"Fill her up with a solution of glycerin. 17.

leave the car here for the rest of the day so you can clean out the cooling system and patch up any leaks you may find

DEAD RACE HORSE "LIVES" AGAIN IN MARVEL OF TAXIDERMY

(Continued from page 10,

breakage. When the plaster was thoroughly dry, it was removed in sections, some weighing 270 pounds, to form the negative mold in which the permanent base would be built up.

The inside of each section of the mold was carefully coated with wax and strips of roofing paper, which had been snaked in paste, were pressed along the entire inside. Three other layers of paper followed, then two layers of burlap, souked in a special composition plaster, and finally, on additional three layers of paper

For a week, the paper and burlap remained in the mold to dry. At the end of that time, it was easily removed, forming a hard shell of unusual strength which reproduced every minute ridge and depression of the organal clay model. In the meantime, the clay model had been taken down and the akcieton prepared for shipment to Australia, where it will be placed on permanent exhibition.

The sections of the hardened paper and burlap were then joined together by means of pails hummered into wooden supports that form part of the wood-and-steel framework which braces the interior of the shell. Coatings of shellac were painted on the exterior, sawdust was sprayed on, and other costs of shellar applied. The main base was complete. Only the fine touches remained to be

One of these fine touches was reproducing

the veins, especially in the legs. To do this, pieces of rope were interested in paste and then glued to the form in the exact positions where the velos of the original animal had been. Close-up photographs of Phar Lap's "million dollar legs," as well as extensive anatomical charts, aided in this phase of the

When it was finished, the final step began. This was placing the akin on the completed mounting. An important new discovery, made by the Jones brothers, was employed at this stage to increase the remarkable fidelity of their reproduction

It is a special flexible plaster. It contains nine secret ingredients and was spread over the course completed mounting under the skin, As it retains its flexibility and elasticity for some time, the new plaster permits the taxidermist to sculpture over the hide after it has been attached. By skillful pressure of the fangers and by pushing and pulling the hair this way and that, he can produce lifelike lines and ripples.

Besides attaching the skin to the form the new plaster also protects it from future attacks by insects or other parasites,

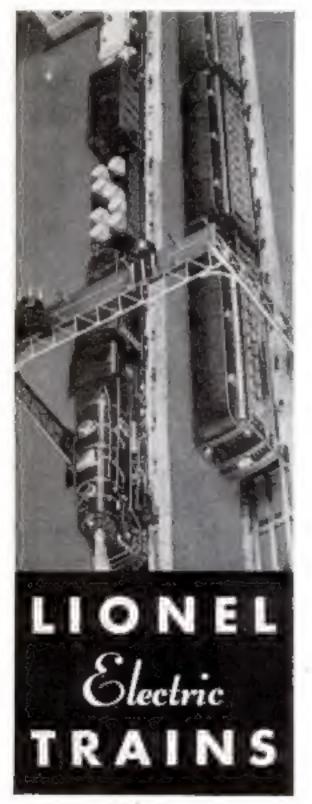
Putting on the cars and tail, and making a few minor touches here and there, compirted the work, an achievement that is receiving recognition as one of the outstanding feats of modern taxidermy

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Amazing Facts of Today's Triumphs of Surgery

(Continued from page 17)

his back. No avail. The meat had lodged in the voice box, plugging the passage to the lungs like a cork in a bottle. The choking man's face turned blue, then black.

There was only one thing to do. The surgeon tere off his dinner coat, stretched the sufferer on the floor and called for a pair of scissors. Using this crude operating instrument, he rapidly cut through the skin of the throat in a straight up-and-down line below the Adam's apple, spread the neck muscles apart, and made an opening in the tough windpipe below.

The surgeon held this opening apart with his fingers. The air rushed into the lungs of the sufferer. In a few minutes he was able to breathe easily again and his normal color returned. His life had been saved by a margin

of less than a minute.

A piece of rubber tubing was then slipped into the opening in the windpipe to provide a direct route for oxygen to the lungs and the patient was taken to the hospital. Here, with time and facilities available, the piece of meat was removed by means of special instruments passed down the throat.

IN EXTREME cases of diphtheria, similar emergency operations are sometimes necessary. Usually, when the accumulating membrane threatens to stop up the air passage, the doctor passes a metal tube into the voice box to prevent sufficiation. But when this special apparatus is not at hand, he must cut into the windpipe.

An operation of this kind, which employed probably the crudest equipment on record, sayed a sailor from choking to death at sea. The opening below the Adam's apple was made with an ordinary jack-knife and into

It was thrust a pipestem!

Nowadays, ocean liners carry complete operating rooms and the latest medical equipment. Some of the most thrilling feats of modern surgery take place on the high seas. Injuries resulting from accidents, and acute appendicitis, are the most frequent causes of operations on shipboard. To keep the rolling of the vessel from interfering with the work, the operating table and all of the equipment are secured to the floor. For a liner surgeon must perform delicate life-and-death operations even

during storms. remember one dramatic instance of the port. A transatiantic lines, bound for New York, was battering its way through a howling gale that lasted four days. Crashing against the side of the yessel, a green mountain of water hurled one of the seamen half across the deck. His head struck the iron house and the whole front of his skull was caved in with the Impact. Only a delicate brain operation, removing the shattered fragments of bone, could

Quickly he was carried below. The operating room became a
bechive of activity. The
big ship swung head-on
to the gale with its
Diesel engines idling.
Then, while the wind
acreeched through the
rigging and white water
burst continually over
the bow of the plunging boat, the surgeon

Enemies Out of the Air

INLESS your nerves are strong, don't read a history of conditions in the hospitals of 200 years ago. It is now hard to understand that they were simply houses of death. The mortality rate, following anything approaching a major operation, was simply appalling. What has changed them? Why is it patients today are seldom the victims of unseen, deathdealing enemies no matter how serious their operations? Next month, Dr. Damrag will answer these, and dozens of other questions, in an article packed with facts more thrilling than any romantic novel ever written.

bent over the still figure on the white table and performed a brain operation that was a success!

During a professional baseball game, several years ago, a pitched ball struck a batsman just above the left temple. He dropped to the ground as if shot. In a few moments he got up and amid loud cheering walked to first base. But when he tried to go to second, he fell in his tracks, unconscious.

At the hospital, it was decided that an artery inside the skull had been ruptured by the blow. Now the skull is a closed box. When bleeding takes place lastice it, the blood must squeeze something and that something is the brain. Hence, the surgeon must open the skull and tie off the bleeding artery, or

death is inevitable.

The patient's scalp was shaved and painted with lodine. Then the surgeon cut down to the hone. By means of a special drill, called a burn, he made several small openings in the skull bone. Through these, he passed a fine wire saw with two handles, cutting out a flap of hone which he turned back. Rough splinters he carefully clipped away with pincers specially designed for the purpose.

Sponging away the blood from the membrane covering the brain, he perred inside. There it was, a jet of blood spurting with each heat of the heart! Quickly he passed a loop of catgut around the spurting artery and pulled it taut.

In a moment all bleeding had stopped and the danger was over. The flap of bone was turned back, the scalp wound sewed up, and the operation was over—an operation without which the athlete would certainly have

died.

On SOME western railroads, operating rooms on wheels have been made part of the equipment of wrecking trains. These special cars enable surgeons to perform emergency operations at the scene of a disaster, saving lives that might be lost if the operation had to be delayed until a distant hospital was reached.

In disasters of all kinds the skill of the surgeon plays an important part. Often, working with unsatisfactory equipment at the scene of an accident, he has to battle

against tremendous odds.

Such was the case, a few weeks ago, in West Virginia. Far below the surface of the earth, the slate roof of a coal mine corridor collapsed. The falling rock caught one of the miners, pinning him by the arms. His companions worked frantically to free him. An automobile jack, sent down from above, was used to pry up the slate so one arm was released. But the rescuers saw that any attempt to free the other arm would bring the whole mass of rock toppling over on the trapped man.

A surgeon responded to a hurry-up call. Entering the cage with his instruments, he was lowered hundreds of feet into the pitch-black mine. Contiously he inched his way along the dangerous corridor where the cave-in had occurred until he reached the scene of the accident. While the other members of the rescue party held aloft their little lamps to illuminate the cavern as best they could, he administered the anesthetic and then, lying flat on his back in the cramped quarters, performed the amputation that trend the injured miner.

Special care is taken in every well-equipped

operating room to provide perfect illumina-Directly above the table a great dome reflects the light downward in such a manner that his hands and instruments cast no shadows. If the electric current should go off during an operation, auxiliary batteries and generators in modera hospitals stand ready to take up the burden of supplying light to the operating room without an instant's delay. Preparing for the unexpected is an important phase of the work of every surgi-

There are many thousands of ailments that human flesh is heir to. Only a few, of course, require emergency operations. But when they do occur, life and death often hang in the balance and the skill of modern surgery is taxed to its utmost to perform some of its most amazing miracles.

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